



**Trak Engineering, Inc.**

**Frank Traknyak, P.E. RESUME**

**Complex at George R. Brown Civic Center (GRBCC) with Garage, Hotel, Office, Retail, and Restaurants** - Trak Engineering, Inc. is the lead MEP firm on a high profile project consisting of 800,000 sqft Garage Hotel and Office complex at the GRBCC. The garage is a 2,100 car garage with skywalks, corporate offices and main lobby to the hotel, retail, restaurants and office complex. The garage has bus parking, tractor trailer loading dock, and a light rail passenger train running through the center of the garage. The hotel will be a 22 story structure above 6 stories of Class A offices which is integrated with the garage. In addition to this complex, the project also includes substantial renovation of the GRBCC which will include a grand entrance from large projection screen and new front facade overlooking Discovery Green and new plaza. Trak is working with WHR Architects on this project. Also included is a renovation of the Hilton Garage which included a new bus terminal in the garage. The total project when completed will be over 1 million Square feet.



**Phillips 66** - Building 101G Laboratory building approximately 18,200 sqft consisting Oxidation, grease, Tribology, Reology, Tech Services, and Blend labs. The building also includes flammable and combustible liquid drum storage and offices.

#### **Completed Projects:**

##### **BASF "The Chemical Company"**



The Chemical Company

Trak has performed MEP engineering and design work at BASF's Freeport Texas plant in three phases for Control Room, office renovation, and a new restroom/showers facility totaling 7,000 sqft. Trak is continuing work with BASF by designing a 12,000 sqft chemical research laboratory in Houston Texas and a 12,000 sqft machine shop/valve shop facility in Freeport Texas.

**Phillips 66** The project involves 120,000 sqft of laboratory and office space for two (2) Phillips 66 lab buildings which include 94 Laboratories; as well as a Hydrogen Sulfide ( $H_2S$ ) lab at the CPL (Chemical Plastics Lab) and GB (Geosciences Building) Laboratory buildings. The lab must remain operational and be renovated in a phased manner to minimize interruptions. The project consists of replacing Make Up Air Handling Units (MAU) to replace four (4) existing air handlers in the CPL building and nine (9) existing air handlers in the GB building is proposed. The total capacity of MAU for this project is 243,000 CFM. In addition to this, new High Plume Laboratory Dilution (HPLD) fans will replace





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sixty (60) existing exhaust fans in the CPL building and seventy (70) existing exhaust fans in the GB building. The total capacity of exhaust for this project is 248,000 CFM. The existing laboratories will be updated with a laboratory air tracking and pressurization control system utilizing supply air valves, general exhaust valves, and fume hood air valves.

**Total Petroleum** Trak has designed a laboratory for renovation in Port Arthur Texas. The design includes an existing 12,900 sqft building which must remain in operation as the construction progresses. Trak is providing MEP engineering consulting design services. Laboratories include Atomic Absorption labs, raw materials lab, general petroleum chemical lab, asphalt lab, Engine Octane lab, flash test lab, and Gas Chromatograph (GC) lab. The building also includes offices, kitchen, and conference rooms.



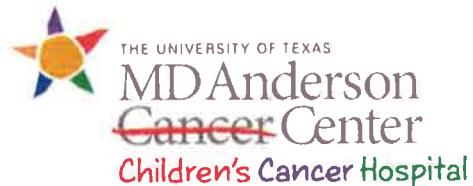
### MD Anderson Cancer Center

This Project is currently in construction. Provided MEP engineering and design services for the renovation of floors 7 and 9 totaling 96,800 sqft of the Alkek building for the Children's Cancer Hospital. The project is described below:

Phase I - Phase I will consist of the full design of Alkek Level 9 through Construction Documents and will also include Construction Administration. Renovation of Alkek 9 to include: one pod for the Pediatric ATC unit, the second pod for PICU monitored beds, and the remaining two units will be utilized for inpatient services for an estimated total



of 39 inpatient beds and 13 – 14 PATC stations. The project will also replace the finishes on the entire 9th floor to enhance the patient and family experience.



Phase II - Phase II will consist of design services of Clark Clinic Level 7 through the Design Development documents, and later the completion of Construction Documents and Construction Administration. Renovation of Level 7 to include reorientation of the Child & Adolescent Clinic to the south in space currently occupied by the Flex Center on Clark Clinic Level 7. The multi-phased renovation will provide for a new waiting/reception area to create distinct spaces for various patient populations. The project will require renovation to coordinate with the new orientation of the clinic. The project will be designed so that the clinic retains its current size of 7,891 net square feet.

The finishes will complement the Alkek 9 palette.

### ExxonMobil Laboratory:



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This existing 30,000 sqft laboratory located in Baytown, Texas will be fully renovated. It consists of a gas chromatograph lab, analytical testing, physical testing, two (2) engine octane engine rooms, Hydrogen Sulfide (H<sub>2</sub>S) lab, flash test room, chemical storage, office and various support areas. The facility consists of 40 fume hoods, 180 snorkel exhausts, and some canopy exhausts designed with airflow lab tracking control system with fume hood sash control and proper lab pressurization control.



Trak is providing the full MEP engineering services for the renovation project which will be performed in five phases in order to maintain the facility operational. Trak issued 150 drawings to properly depict the complex renovation of the MEP system on this projects. Two (2) new air-handlers will be added totaling approximately 100,000 CFM requiring 770 tons of cooling from the chiller water plant. Also provided are new laboratory dilution fans with manifolded exhaust totaling almost 100,000 CFM and new corrosion resistant exhaust ductwork. The majority of the supply ductwork will be utilized where possible.

Trak is provided controls and plumbing design for distribution piping for new high purity gasses, high purity water including a new liquid nitrogen tank and associated piping. The plumbing shall include new chemical waste and vent lines and emergency showers and eye washes to support the lab functions. Electrical systems was designed to support items described above with emergency generator backup.

#### **Nalco Chemical Laboratories:**



In total the project MEP systems designed by Trak will support 104 chemical fume hoods for 30,800 sqft of laboratories with airflow lab tracking control system with fume hood sash control and proper lab pressurization control. The project is a conversion of existing office space on the second floor to two chemistry laboratories with 36 fume hoods similar to the arrangement of the existing first floor laboratory which also has 36 fume hoods. The in addition to this second and first floor labs, the mechanical systems is sized for 18 future fume

hoods in the existing training room area on the second floor 14 future fume hoods directly below on the first floor. The majority of the existing air handler equipment was utilized; however, a new air handler with a capacity of 36,400 CFM needed to be included in the design to serve the new 2nd floor lab renovation.

New exhaust fans on the roof was sized to accommodate the new lab on the second floor, the existing lab on the first floor, and the future hoods described above.

The exhaust fans consists of a fan assembly with five (5) laboratory dilution fans with a total capacity of 100,000 CFM tying in all new and existing exhaust ducts to the manifold of the new fan assembly and demolishing the existing fans. The design incorporates ductwork for the





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future fume hoods.

Additionally Trak provided plumbing design for distribution piping for new high purity gasses, high purity water including a new liquid nitrogen tank and associated piping. The plumbing shall include new chemical waste and vent lines and emergency showers and eye washes to support the lab functions. Electrical systems was designed to support items described above.

### **Hexion Laboratories:**

Performed engineering services for two Hexion Projects (Now Momentive Specialty Chemicals) :

*1. Stafford Texas Laboratory:* Providing MEP consulting services for the design of a new 8,750 square foot (sqft) laboratory and office suite and the renovation of an existing 5,000 sqft lab total project 13,750 Sqft. The project includes two new 22,000 cfm air handlers, and 350 ton liquid chiller ductwork, and controls. New Plumbing and electrical is also included to support all laboratory functions.



*2. Norco Louisiana Laboratory:* Project includes the renovation of a two story laboratory building approximately 13,200 sqft which will include new air handlers, ductwork distribution, controls, centrifugal chillers, cooling towers, and associated pumps. Plumbing and electrical will be modified to support the lab and mechanical systems.

### **Texas A&M Kingsville (TAMUK), Biology Earth Science Laboratory Building**



This project is an existing two story Biology Earth Science laboratory building approximately 31,340 square feet of renovation that will house teaching laboratories, vivariums, research laboratories, offices, lecture halls, autoclave, and common areas for the purposes of teaching and research of biology earth science. Air handlers and lab exhaust fans will be replaced and associated controls and ductwork to match the new architectural layout.

Room pressurization and fume hood controls are achieved with a smart laboratory control system for a safe and energy efficient VAV laboratory. Plumbing includes central lab air, vacuum, acid neutralization system, high purity lab water, and new restrooms.

### **University of Texas Medical Branch (UTMB) projects:**

Radio Pharmacy- Provide construction documents for the HVAC system and associated controls serving the proposed renovated Radio Pharmacy Suite on level 2 of the Clinical Sciences Building that includes the following rooms:

1. Sterile work room
2. Ante room
3. Blood room and blood draw room
4. Non sterile room





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Central Sterile Suite - Provided a feasibility study for the mechanical, electrical, plumbing, and fire protection building systems for the Central Sterile Suite at the Rebecca Sealy Hospital. The next phase will include full design to provide construction documents. The project includes new supply and exhaust distribution system, terminal air valves, exhaust fans, and pressurization controls.

**Spring Creek Surgery Center Tomball Texas :** Redesigning of 12,300 sqft of the HVAC and



electrical systems to meet current codes and to ensure that the requirements set forth by the Texas Department of State Health Services, Texas Administrative Code Title 25, Chapter 133 are met. An analysis of the entire building, detailed report, and construction documents were provided to correct code and capacity deficiencies of the building systems.

#### **University of Houston Downtown (UHD):**

1. Student Government Administration Office: Scope of this project is to convert approximately 1,700 square feet of garage space to a new Student Government Office and provide a new chilled water air handling unit (AHU) located in the new mechanical room. HVAC utilizes VAV boxes with hot water tempering coils. New lighting and electrical power with new electrical feeders and distribution was provided. Plumbing for a kitchenette was designed. Controls system with control diagrams and sequence of operations tied into the existing campus Facility Management System (FMS) was designed.
2. Acid Neutralization & Acid Waste Piping Installation: Replace old chip tank used for acid waste serving 142 laboratory sinks with a new automated system meeting the current plumbing codes, replace existing PVC piping which is not conducive to chemical and acid waste systems with Polypropylene or PVDF piping designed for such a service. The Effluent is monitored and alarms are tied into the existing campus Facility Management system (FMS). Electrical power to serve the effluent monitor controller tied to the campus FMS.
3. Data Centers: Competed three (3) main frame data centers in the main building, Shae Street building, and academic building with raised floor distribution maintaining tight temperature and humidity requirements. Each data center employs a Liebert DX split system CRAC Units with cooling, heating, and humidity control. Each system consisted of N+1 Redundancy with 100% standby back up. Each system has a dedicated stand alone Micro processor controller for each unit.
4. 5th Floor Library renovation of One Main Street: Trak completed the design of an eight (8) phase renovation design for a project over 64,000 sqft of the entire 5th floor of two towers at the University of Houston. This challenging project utilized creative ductwork design with forethought of





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the end product and temporary ductwork back fed to areas and new air handlers installed in an area with occupants in offices, library, coffee shops, data center, conference rooms which can not be disrupted. The demolition becomes just as critical as the new ductwork, piping, and electrical and all has to be carefully orchestrated at critical times to successfully execute the construction without disruption. New electrical circuits through new panels have been fed to the new locations to facilitate un-interrupted power to existing locations. The Temperature is monitored and alarms are tied into the existing campus Facility Management System (FMS).

5. Chemical Preparation Lab and Chemical Storage: Renovation project approximately 2,000 sqft of an existing chemical preparation laboratory and fire rated chemical storage rooms located on the 8<sup>th</sup> floor on the North tower. The project consists of new laboratory exhaust system serving the laboratory, fume hoods, chemical storage rooms and general exhaust utilization laboratory dilution exhaust fans and stainless steel ductwork. Pressurization of supply and exhaust and fume hood exhaust is controlled by a laboratory air tracking control system. Supply air is provided by a new makeup air handler (100% outdoor air) terminal units and ductwork distribution.
6. Additions suite
7. HVAC system modification for the S405 office suite, approximately 3,500 square feet, to match the new architectural arrangement and utilizing the existing HVAC system to the maximum extent possible. The associated control system was also designed to matched the new system. Outdoor air (OA)is provided by a new makeup air handler (100% outdoor air) to supply conditioned OA to the existing air handler based on CO<sub>2</sub> control monitoring. Trak provided mechanical and electrical engineering consulting services to generate mechanical and electrical drawings and specifications for this project.

**Royal Purple laboratory** - Design Build project for a 3000 sqft laboratory renovation for Royal purple who manufactures high performance lubricants for automotive, industrial, marine, motorcycle and racing applications Trak provided Mechanical, Plumbing and Electrical, engineering and design services to gut and upgrade the HVAC and Electrical serving the existing laboratory, oven room, instrument room, solvent storage room and corridor. The project is a working lab and the design accounted for the appropriate phasing so that the lab could continue to operate during construction.



**Continental Carbon Nanotechnology, Inc. (CCNI):** Nanotechnology test and research facility in approximately 1,800 sqft located on the property at 16850 Park Row, Houston Texas 77094. Provided MEP and gas monitoring design and engineering for a high hazard Class 1 Div 2 classified facility for the test, research, and manufacturing of carbon nanotube material. The facility consisted of reactor, oxidation, fume hoods, mixing rooms, and office space.

**Baylor College of Medicine:** Currently providing MEP engineering and design services for the renovation of four (4) small laboratories (approx. 1000 sqft each) as described below:

1. Specialty lab approximately with MRI room, calorimeter room (with Versamax and Physioscan equipment), holding room for approximately 100





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mouse cages, treadmill room, surgery room, clamping station room, separate area for MRI equipment.

2. Tissue engineering histology room with a staining station, microscope station, paraffin embedding station, a new 5'-0" chemical hood, as well as a freestanding Cryostat and Tissue-Tek processor Also included will be a robot room, and will house at least two robots, some immunological monitoring equipment, and lab sink.
3. Robot lab with two robots and multiple pieces of lab equipment, a sink, a relocated fume hood, and a separate workstation room. In addition to these rooms there is a lab equipment room with 80 lab freezers. The lab has high purity carbon dioxide and vacuum systems.
4. Microscope computer lab with 4 microscope stations and 5 computer workstation areas, bench space, lab sink, and a miscellaneous pieces of lab equipment.

#### **Texas A&M BSL 3 Lab:**

Performed consulting services to address (3) three BSL laboratories:

1. Perform Field work to verify HVAC plans provided to us and note any discrepancies.
2. Draw a one line diagram with the correct duct runs.

The Field work performed was for the following (3) three following locations:

1. Lab animal Resources and Research (LARR) Facility
2. Veterinary Medical Research lab Center Addition
3. Reynolds Medical Science building



**NASA, Houston Texas:** On going contract providing MEP Engineering and Design services to generate construction documents to complete numerous small renovation projects. Some projects

require research, field evaluations, and the generation of reports to describe and depict proposed solutions. Some projects include:



- Provided reports and recommendations for BSL 3 laboratories and for laboratory systems utilizing Perchloric Acid.
- Building 18 Air Handler Replacement: The second floor air building was replaced. Unit capacity CFM was 5,500 CFM.

- Building 24 Central Plant Air Handler Replacement: This project consisted replacing the control room air handler in NASA's central plant with a new 7,500 CFM unit.
- Building 44 Air Handler Replacement: A make up air handler 9300 CFM providing the instrument testing building with fresh air was replaced. An air handler serving an electronics and instrument lab 1,500 was replaced.

Note: All units replaced indicated above included steam (or hot water), chilled water, VFD, and new controls



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**Fort Bend EMS Addition:** This scope of this design build project was to enclose a breezeway between two existing buildings for expansion to facilitate a men's and women's restrooms and emergency response staging area at the Fort Bend County Emergency Management facility in Rosenberg, Texas. Trak provided MEP consulting services to generate MEP drawings, specifications and construction administration for this project.

**Intertek, Houston Texas:** This laboratory was Recognized in an article in "Exploration + Process" Magazine April 2009. Trak was Prime consultant providing MEP construction documents and construction administration services for a Hydrogen Sulfide (H<sub>2</sub>S) laboratory. Laboratory featured a H<sub>2</sub>S fume hood with integral scrubber and a general exhaust carbon filter scrubber; as well as, an H<sub>2</sub>S gas monitoring system. The exhaust consists of high plume dilution laboratory fans with N+1 redundancy. The carbon filter and lab fans sit on a structural steel platform on the roof. Laboratory controls for proper room pressurization and temperature control tied into the building automation system (BAS) are also included, as well as, a CCTV for video monitoring.



**Update:** This H<sub>2</sub>S Laboratory has proven to be so profitable for Intertek that Trak Engineering, Inc. have been called back and we are currently working on expanding the laboratory by 250%.



**TechCorr, Houston Texas:** Prime consultant providing design basis criteria and report for a metallurgical testing laboratory and an R&D lab.

**Shell Chemical and Refinery Production Laboratories:** This Laboratory has been nominated for the "*Project of the Year Award*" to be awarded in 2011 Globally! This is a production laboratory for both the chemical and petroleum industries in Deer Park, Texas. The production laboratories are currently designed to monitor the production of solvents, phenol, olefins, and other petroleum products. This project is currently in the Construction phase. Measurements of the product are performed utilizing gas chromatography with Ultra High purity gasses (gas purity level 6). The lab is approximately 11,000 sqft and has 42 fume hoods driving the need to provide unusually high supply and exhaust to and from the laboratories (4.4 cfm/sqft).

**Fire protection system:** The high hazard chemicals, flammables, combustibles and flammable gasses along with the mass storage of these commodities provide the need for a challenging fire protection suppression system. Trak designed and engineered a pre-action system with a high design density and design area.





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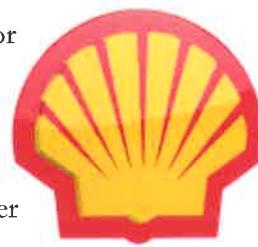
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**Motiva, Petroleum Production Laboratories:** MEP engineering and design for a Production laboratory for the petroleum industries in Convent Louisiana. The production laboratories are currently designed to monitor the production of jet fuel, gasoline, toluene, acetone, diesel fuel, and other petroleum products. This project is currently in the Construction phase. Measurements of the product are performed utilizing gas chromatography with Ultra High purity gasses (gas purity level 6). Also contained within the lab is a octane engine test room with 4 test engines. The lab is 14,000 sqft and has approximately 22 fume hoods.

Fire protection system: The high hazard chemicals, flammables, combustibles and flammable gasses along with the mass storage of these commodities provide the need for a challenging fire protection suppression system. Trak designed and engineered a pre-action system with a high design density and design area.

**Shell Metallurgical Laboratory:** Provided MEP engineering and design for the conversion of office space to a metallurgical laboratory space in Deer Park, Texas. The project was approximately 2,100 sqft and required new makeup air handling units, lab high plume exhaust fans, and laboratory controls.

Fire Protection: This existing facility included an existing wet pipe sprinkler system that needed to be reconfigured for a new architectural layout.



**KBI Pharmaceutical –** Consulting firm to a pharmaceutical company to build an FDA GLP/GMP compliant complex in Kunming, China. The complex initially will perform pre-clinical research using primates. Trak Engineering, Inc. established the design criteria, reviewed drawings and calculations, generated reports, and provide continual monitoring of the design and construction process. The complex includes the following buildings:

1. GLP Quarantine facility two stories in height, 130,000 sqft.
2. GLP Study Facility two stories in height 45,000 sqft.
3. R&D Lab two stories in height, 38,000 sqft.
4. Pharmaceutical and administration building, two stories in height, 32,000 sqft.

**University Of Houston Diedrich coffee shop:** Renovation of a 1500 sqft existing space to convert into a cyber café serving gourmet coffee and pastries at the Universities Hilton hotel.

**University Of Houston Distinguished Conference Room:** Provided construction documents for a showcase conference room honoring distinguished Alumni. The conference rooms is approximately 600 sqft and is used for board meetings and training sessions. Fire Protection: This existing facility included an existing wet pipe sprinkler system that needed to be reconfigured for a new architectural layout.

**Russo's Italian Restaurant and Wine Bar:** Complete renovation of an existing space in a strip mall for an Italian Restaurant with coal fired pizza oven and full kitchen.



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**Oriental Religious Facility:** Brand new 40,000 sqft religious facility designed as an ancient oriental worship sanctuary. The multipurpose facility has a library and a full 4,500 sqft kitchen capable of serving up to 1000 people.

**Hewlett Packard Office Renovation:** Provided construction documents for a high end office renovation approximately 12,500 sqft.

**Fire Protection:** This existing facility included an existing wet pipe sprinkler system that needed to be reconfigured for a new architectural layout.

**Material Testing Lab:** Provided consulting services for a Highly specialized Hydrogen Sulfide ( $H_2S$ ) lab for Honeywell Process Solutions, performs material and corrosion testing primarily for the petroleum and gas drilling and exploration industry. This new 30,000 square foot facility encompasses numerous laboratories and testing equipment utilizing extremely hazardous, explosive, flammable, and toxic chemicals and gasses. The facilities exhaust system utilizes a central hydrogen sulfide scrubber that can eliminate most other chemicals as well from the air stream. A dedicated perchloric acid hood with a wash down system is also included. The facility also includes 50 high pressure and temperature testing vessel stations requiring various utilities, projectile protection, air monitoring and emergency exhaust purge.

**Fire protection system:** The high hazard chemicals, flammables, combustibles and flammable gasses along with the mass storage of these commodities provide the need for a challenging fire protection suppression system. Trak pre-engineered a wet pipe system with a high design density and design area.

**Oil and exploration industry Research Laboratory building Cambridge, MA:** Project scope was a 240,000 sqft tenant laboratory fit out for **Schlumberger Doll Research**. The programming included 24 user groups and 58 different labs including a Hydrogen Sulfide ( $H_2S$ ) that provide research and services for the oil and exploration industry. An extensive Geology department included mineralogy labs, rock sampling and crushing labs, microscopy, and NMR lab.

In addition to Geology the laboratory facility houses chemical labs with fume hoods, MRIs, Xray, clean rooms (class 100,000; 10,000; 1,000 and 100), material and instrument testing labs; as well as, acoustics, laser, and optics lab. The labs will be a variable air volume (VAV) system and the offices will invoke a new chilled beam technology that reduced the total supply air by over 50,000 CFM.

Some chemical used by the client will be used requiring scrubbers and separate independent hoods such as perchloric acid and hydrogen sulfide. The remaining exhaust will utilize a headered lab and fume hood exhaust system totaling 190,000 CFM using laboratory high plume dilution exhaust fans. Twelve of





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the labs incorporated air monitoring systems that would summon an emergency exhaust and supply air system to purge and dilute the air in the event that the air was measured to be unsafe.

Two kitchen exhaust fans were provided for the kitchen hoods. The design also incorporates a library, auditorium, cafeteria, kitchen, exercise, yoga room, and locker rooms.

### **Below is a list of University of Massachusetts Laboratory and Hospital Projects:**



**UMass Boston Chiller Replacement Project:** The scope of this project was to demolish three existing liquid chillers, install three new liquid chillers totaling 6000 tons of cooling. It also included installing new chilled water pumps, piping header, and refrigerant emergency exhaust system with refrigerant monitoring system. The chiller plant was completely automated with a chilled water optimization control system that enables and disables the chillers, valve actuators, chiller pumps, condenser water pumps, and the sea water pump house. Also included was a 10 "chilled water

equalization line that connects the campus north and south cooling loops and refurbishing of the sea water pumps house systems.

**Gordon Wallace lab and clean room:** This project entails a 3200 sqft lab for ecological research. This lab consists of a class 10,000 clean room within a lab using high acid concentrations generating a highly corrosive atmosphere. Air pressurization was critical and was achieved with a passive Phoenix Controls system. A new dedicated air handler and exhausts system was provided.

**Jamaica Plains Biological Lab Clean Room HVAC Project:** Clean room serves several GMP production laboratories manufacturing tetanus and all childhood vaccines. This project involves the installation of a new 13,500 CFM, custom air handler penthouse unit exhaust fans, pumps, piping and associated DDC controls. The air handler penthouse unit has an integral 100 ton air cooled liquid chiller, pumps VFD's steam pressure reducing stations, heat exchanger, HEPA filters, and energy recovery system. The clean room requirements is a class 100,000 with some areas requiring to be a class 10,000 utilizing terminal HEPA units. The system was validated and FDA approved.



**Ultra High purity clean steam generator and Process piping project:** FDA approved design over 1000 feet of distribution piping up to 4 inches in diameter serving autoclaves, fermenters, process tanks, Steam in place (SIP), and other various pharmaceutical processes. This process piping is used for the manufacturing of all child hood vaccines, tetanus, and monoclonal antibodies at the Massachusetts Biological Laboratories which is a GMP FDA approved facility and the systems were validated. Project consists of 3500 pounds per hour clean steam generator that utilizing WFI quality water.



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**Animal MRI magnet building:** Provided design documents and construction administration including commissioning of a magnet building housing a 4.7 tesla animal MRI performing images on rhesus monkeys. The 3500 sqft facility was designed as a bio level 3 and included animal operating room, holding rooms and vivarium for the rhesus monkeys. The exhaust system included bag in bag out HEPA filters to ensure the bio-level.

**Animal NMR Lab for Neuro-psychiatric research:** Provided construction documents for HVAC, and plumbing to support a 9.4 tesla Nuclear Magnetic Resonance (NMR) specimen imaging equipment. Equipment required supplemental cooling and non ferrous ductwork, -100 dewpoint compressed air, and oxygen depletion monitor which enabled an emergency exhaust fan.

**Zamora and Gilmore labs:** Complete gut and renovation of existing labs with new HVAC plumbing and fire protection. These state of the art labs featured VAV HVAC system supply and exhaust air tracking system. Laboratory type air valves controlled and tracked the supply hot and cold deck, general room and fume hood exhaust. Lab fume hoods air valves are controlled by sash position. Plumbing systems included RODI, vacuum, natural gas, compressed air, emergency eye wash and shower system.

**Aquatics Marine Biology Laboratory:** Provided HVAC, plumbing and fire protection construction documents for a laboratory consisting of tanks with over 5,000 gallons housing marine animals. HVAC systems were designed to address high humidity and cooling loads associated with large quantities of warm water and equipment load. Plumbing systems were designed to handle the unique filtration system , process piping , and equipment utilities sustain marine life.



**Neurological Research Institute:** Reviewed design documents for HVAC, plumbing and fire protection, and provided modifications for tenant fit out including a 20,000 sqft vivarium. The building is an 80,000 sqft research facility. Provided design documents and construction administration to alter several areas to address specific researcher's needs and requirements.

**Aaron Lazar Research Building:** A 360,000 sqft research and life sciences facility with a 36,000 sqft vivarium. Established design criteria and approved design documents for HVAC, plumbing and fire protection. Assisted in commissioning and provided engineering support and construction administration.

**Animal Quarter and Substation HVAC unit installation:** Two new air handlers were provided totaling 50,000 CFM. One unit serves an entire wing of animal vivarium and operating rooms.

This unit is provided with all the features required for AAALAC certification. The other unit is a heating and ventilation unit that serves mechanical and electrical substations. Project was completed with no shut down of the existing system and only a 3 hour change over.

**5<sup>th</sup> Floor laboratory exhaust fan Project:** This project was performed to convert office areas utilizing return duct air system to 100% exhausted system.



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**Eunice Shriver Kennedy Center HVAC Renovation and unit replacement:** This project consisted replacing all air handling units in the building, laboratory exhaust fans, replacement of the majority of the steam and chilled water components, and reconfiguring the steam, hot water, and chilled water systems. Two new laboratory makeup air handlers totaling 30,000 CFM were provided, a new 6,000 CFM unit serving the vivarium was provided with 50% redundancy on emergency power, and 5 laboratory exhausts venture high plume dilution lab fans exhausting general air and fume hoods was also provided.

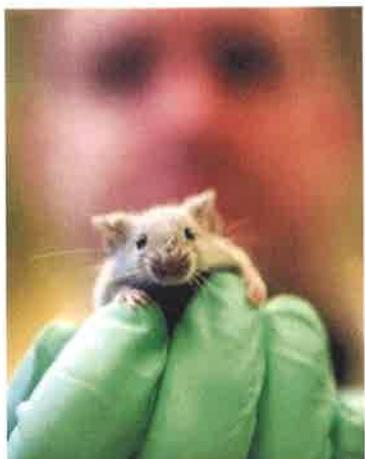


**Rose Gordon Research Laboratory:** This existing 24,000 sqft building was totally gutted and renovated with completely new HVAC, plumbing and fire protection systems. HVAC systems included hot water boilers, lab make up air handlers totaling 48,000 CFM, office air handlers , vivarium air handler with 50% redundancy connected to emergency power, air cooled liquid chillers, hot and chilled water pumps, all controlled by a DDC energy management controls system. The laboratory exhaust system featured venture high plume dilution lab fans exhausting general air and fume hoods. Fume hoods featured air valves controlled by sash position. Plumbing system systems featured acid waste and vents, acid waste neutralization system, vacuum pump system, RODI system, emergency eye wash and shower system. Laboratory gases included natural gas, compressed air, vacuum, and carbon dioxide. Also performed full sprinkler design, hydraulic calculations, and hydrant flow testing.

**Jamaica Plains Biological Lab Clean Room HVAC Project:** Renovation of a space to manufacture monoclonal antibodies within an FDA approved manufacturing laboratory. This project involves the installation of a new 4,000 CFM, custom air handler, and exhaust fan, piping and associated DDC controls. The system is a 20 ton air cooled split system. The clean room requirements are a class 10,000 was validated and approved by the FDA.

**Tissue Engineering laboratory suite:** Renovated an existing laboratory to modify mechanical systems to meet occupants specific needs. The laboratory was upgraded to an active fume hood control and supply air tracking system.

**Underground Steam Condensate Project:** Over 1200 feet of underground steam condensate piping was installed utilizing pre-engineered piping system. The project also consisted replacing all power plant boiler pressure relief valves that served the Worcester State Hospital.



**BSL-3 Ready animal Suite:** Designed an animal suite to BSL-3 standards for future certification when a program warranted a science that required this biological level. The animal suite was approximately 6,000 sqft with procedure rooms, autoclaves, animal



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holding, air lock vestibules, ante rooms, and bag in bag out HEPA exhaust.

**Vivarium Renovation For Ventilation Cages:** Research Director from NIH required the entire animal quarters be outfitted with HEPA Filtered ventilated cages. Custom thimble connectors to the cages were designed and the system designed and rebalanced for the proper air changes. A new animal watering system utilizing RO water was designed and installed.

**Pharmacology NMR Lab:** Provided HVAC, and plumbing to support a 12.5 tesla Nuclear Magnetic Resonance specimen imaging equipment. Equipment required supplemental cooling and non ferrous ductwork, -100 dewpoint compressed air, and oxygen depletion monitor which enabled an emergency exhaust fan.

**Confocal electron Microscope:** provided spot cooling and exhaust for this highly specialized microscope.

**Biotech1 first floor Office suite:** This project consisted of over 13,000 sqft of office space completely gutted. Provided design documents for HVAC plumbing and fire protection. The HVAC system consisted of fan powered terminal boxes and radiant hydronic heating. Terminal boxes are supplied by a refurbished air handling unit. All new DDC controls were installed.

**Clean Room Projects:** Experience in engineering and design several Class 100, 1,000, and 100,000 type clean rooms. As project engineer, he has led several projects from conception, to design, and construction. Projects consisted of complete HVAC, controls, and fan powered terminal HEPA filter modules for a vertical airflow pattern system. Environments were tightly controlled for temperature, humidity, and static pressure. Continuous monitoring of particulate count was performed. Clients were primarily in the medical and electronic manufacturing industry.



**Cathertization suite:** Produced design documents and performed construction documents for a 3500 sqft cathertization suite. Provided a new 30,000 CFM air handler to serve a total of 6 suites

**Emergency Room Renovation:** Assisted in the design development of a 2 story 50,000 sqft emergency room renovation complete with new mechanical room and two 20,000 CFM air handlers

**Surgery operation rooms supplemental cooling systems:** Provided DX cooling system to supplement inadequate house air with. This was performed on two operating rooms and included new controls, condensing unit, and DX coil. One operating room serves as a burn unit and required both a heating and cooling unit. Both operating rooms had to be performed with out any down time due to a sever back log of operation.

#### **Air Hander Replacement Project :**

**Animal Quarter and Substation HVAC Air Handler Replacement:** Two new air handlers were replaced totaling 50,000 CFM. One unit serves an entire wing of animal vivarium and operating



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**Frank Traknyak, P.E. RESUME**

rooms. This unit is provided with all the features required for AAALAC certification. The other unit is a heating and ventilation unit that serves mechanical and electrical substations. Project was completed with no shut down of the existing system and only a 3 hour change over.

**Eunice Shriver Kennedy Center Air Handler Replacement:** This project consisted replacing all air handling units in the building, Two new laboratory makeup air handlers totaling 30,000 CFM were replaced, a new 6,000 CFM unit serving the vivarium was provided.

**Rose Gordon Research Laboratory Air Handler Replacement:** This existing 24,000 sqft building was renovated replacing lab make up air handlers totaling 43+90,000 CFM, office air handlers , vivarium air handler.

**Jamaica Plains Biological Lab Clean Room HVAC Project:** FDA approved manufacturing laboratory. This project involves the installation of a new 4,000 CFM, custom air. Unit served class 10,000 clean room validated and approved by the FDA.

**Note:** All units replaced indicated above included steam (or hot water), chilled water, VFD, and new controls

### Miscellaneous University Projects:



**UMass Boston Student Center, office, and function hall complex:** 380,000 sqft building consisting of book store, student center, ballrooms, offices cafeteria, kitchen and function rooms. Reviewed the HVAC, plumbing and fire protection drawings. Generated the commissioning specification for the project and performed all the commissioning for every system.

**Medical Library renovation:** Generated design documents for renovation consisting of approximately 40,000 square feet. The project consisted of HVAC system utilizing existing air handlers but with new terminal fan powered boxes and new steam to hot water heat exchanger skid package and associated DDC controls.

**University Of Houston Diedrich coffee shop:** Renovation of a 1500 sqft existing space to convert into a cyber café serving gourmet coffee and pastries at the Universities Hilton hotel.

**University Of Houston Distinguished Conference Room:** Provided construction documents for a showcase conference room honoring distinguished Alumni. The conference rooms is approximately 600 sqft and is used for board meetings and training sessions. Fire Protection: This existing facility included an existing wet pipe sprinkler system that needed to be reconfigured for a new architectural layout.

#### **Boiler Fuel Conversion and energy Conservation Project:**

Replaced existing electric boilers with two 800 horsepower and one 400 horsepower efficient gas fired boilers. Project also included providing hot water pumps with variable frequency drives (VFD) and new natural gas service. Other energy measures included providing VFD's on all chilled water secondary pumps on campus and providing active sash control on approximately 220 fume hoods.



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**Chang Building Warehouse:** Produced design documents for fire suppression system and steam heating of a 25000 sqft warehouse. Produced full fire protection drawings and hydraulic calculations as well as hydrant flow tests.

**Hospital/Medical school Telecommunication rooms expansion:** Designed the HVAC and Fire protection system for the Floor Telecommunication Rooms (FTR) that contain IDV with active voice and LAN electronics with associated cabling and connections. Several FCR(s) located to address both vertical and horizontal connectivity infrastructure.

**Information Services (IS) 9<sup>th</sup> floor computer center:** Provided HVAC to maintain critical temperature for high computer load serving the campus website group. This group designs and maintains the campus wide website utilizing LAN servers and high powered computers.

**Fire Protection Sprinkler and Fire alarm project.** Provided Project management services to add a complete fire suppression and fire alarm system to two occupied buildings with staff, students, and researchers. The two buildings are the Wheatly building ( 300,000 sqft) and the Science building (232,000 sqft) at the UMass Boston Campus. Provided engineering design criteria and performed hydraulic tests and provided supervision of the design. The design was started in 2003 and construction will be completed in March of 2007. Total construction cost is \$5.6 million.

### **Fire Protection Projects:**

**Univision (KUVN, Channel 23), Dallas, TX:** Designed complex system for television and news studio center, located on the 19th floor of an existing 26 story high rise building. The fire protection system consisted of a double interlocked pre-action sprinkler system for the tech center with an FM-200 gaseous suppression system protecting under the raised floor. The remaining areas were protected by a wet pipe sprinkler system. Produced design documents and calculations.

**Fort Bliss Army Base, Texas:** Assisted in the design of approximately 8 buildings and two aircraft hangars. The hangars contained Aqueous Film Forming Foam (AFFF) suppression systems with fire pumps. The other buildings contained conventional wet pipe systems. Was responsible for several of the designs and checking the entire project for technical accuracy and quality control.

**Office Building, General Services Administration (GSA):** Conducted Life Safety building survey inspections to ensure conformity to NAPA 101. Determined if the means of egress, smoke control, hazardous areas, fire separation, building construction, elevator shaft and controls, HVAC systems, exit signs; as well as the fire suppression, alarm, and detection systems were in accordance with the Life Safety Code. Submitted detailed reports containing violations, findings, and recommendations; rated buildings in accordance with NAPA 101M.

**Carswell Air Force Base Naval air station in Fort Worth, TX:** Performed engineering services involving fire protection systems in accordance with MIL-HDBK-1008B and NAPA codes for several military contracts. The work included an existing half a million-gallon storage tank. The project also includes new overhead and under-wing pre-action Aqueous Film Forming Foam (AFFF) systems for all aircraft hangars. Special pump flow performance acceptance test that was performed on the existing water pumps in accordance with NAPA 20.



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## Frank Traknyak, P.E. RESUME

Sizing all equipment and piping, generating detailed electronic drawings and specifications for construction, hydraulic calculations, cost estimates, reports, field measurements, onsite inspections and testing of final fire suppression and fire alarm systems. Also performed hydrant flow tests, and reviewed shop drawings.

**STAPLES Office Supplies, Distribution Center:** As the Lead Fire Protection and Plumbing Engineer; Frank was responsible for producing construction documents for a warehouse distribution center approximately 1 million square feet in size. Generated all the HVAC calculations, interpreting building codes and local amendments, and determine design parameters from NAPA codes and Factory Mutual requirements.

This facility included ESFR suppression systems in the low bay area and standard ceiling sprinkler system with in-rack sprinklers in the high bay area. The facility included: fire protection pumping systems containing an electric and diesel fire pump each with a capacity of 2500 g.p.m. and a 300,000 gallon backup water supply tank. The warehouse contains 30 wet pipe sprinkler fire protection zones designed accordance with NAPA 13 and 231C.

In addition, he discovered that there were extra high hazard materials such as flammable and combustible liquids and aerosols products which require unique design parameters as delineated in NAPA 30 and 30B. An alternative design was submitted to the insurance company and authority having jurisdiction. This alternative design was accepted saving the client millions of dollars.

Plumbing consists of sanitary sewer systems and bathroom lavatories, and specialty plumbing systems such as: acid neutralization basins and sand trap for the battery charging area.

**HEB Supermarkets:** Generated design documents in order to provide air conditioning for occupant comfort in their warehouse facility. The 800,000 square foot facility required eight 30-ton and four 60-ton direct expansion A/C units and air distribution ducts throughout. Also worked closely with the equipment manufacturer to coordinate and ensure a smooth installation. Demolition drawings were also generated to remove existing evaporative cooling systems.

**Wal-Mart Warehouse Distribution Centers:** Assisted with the designing and sizing equipment for fire protection, HVAC, and plumbing systems for facilities over 1 million square feet in size. Generated detailed electronic drawings and specifications for construction, performed sizing calculations, interpreted building codes and local amendments, and determined design parameters from NAPA codes and Factory Mutual requirements.

These warehouse distribution centers included: fire protection pumping systems containing (2) 2500 g.p.m. pumping system and larger, with water supply tanks as large as 300,000 gallons. The warehouse typically included 30 wet pipe sprinkler fire protection zones each with in-rack sprinkler systems in accordance with NAPA 231C. The facility contained extra high hazard combustibles in storage such as aerosols, which requires unique design parameters as delineated in NAPA 30B.

**Mistersky Power Station, Detroit Public Lighting Company:** Designed and specified a fixed extinguishing carbon dioxide fire alarm and detection system.



**Trak Engineering, Inc.**

## **Frank Traknyak, P.E. RESUME**

**Bellfonte Nuclear Plant, Hollywood, AL:** The 2,600 MW electric plant required extensive modification to existing fire protection systems totaling more than \$8 million. Over 12 buildings were involved. Responsible for performing intensive hydraulic calculations for existing multi-loop underground and building suppression systems. These calculations demonstrated that the existing systems failed hydraulically and seemed as the basis of design for modification of the existing fire protection systems. Engineered and sized new fire protection systems, piping, and equipment which included a 6,000 g.p.m. fire pump station with four diesel and electric pumps and 500,000 gallon supply tank. Engineered all underground fire water main distribution system. Also engineered the building water fire protection suppression systems that fed several types of systems. Sized the low pressure CO<sub>2</sub> system utilized in the turbine generator exciter and the emergency diesel generator building.

**U.S. Department of Energy (DOE) Y-12 Plant, Oakridge, TN:** Assisted in the design layout of a fire protection monitoring system for 500 fire protection valves, covering over 250 buildings. The project entailed point to point trial wiring design between data gathering panels (DGP) and all fire protection valves throughout the entire plant. Performed detailed drawings of internal wiring of DGP, aerial, and building wire run layouts. Also engineered and designed steam heating and ventilating systems on several buildings. Performed hydraulic calculations on fire protection systems.

**Beaver Valley Nuclear Power Station:** Modeled and calculated the impact of a fire in areas containing highly combustible liquids. This was performed in order to determine temperature variations in areas with in fire area and in areas directly adjacent. This engineering model was used in the acceptance of non-UL rated fire dampers.

### **Building, Office and High-rise projects:**

**Office Building, Pennsylvania Fish and Boat Commission, Harrisburg, PA:** Designed a pressurized under-floor HVAC system for the headquarters of the PA Fish and Boat Commission. This 50,000 square foot office building was designed as a “Green Building”; i.e., energy efficient, environmentally conscience, and a pleasant working environment. The emerging technology of pressurized under-floor air distribution HVAC system is modular in nature that virtually eliminates renovation construction, when floor plans change. It also provides individual control, ideal temperature, and humidity right at the occupant’s working level. The system consisted of high efficiency condensing type boilers, air-cooled liquid chillers, and air handlers with high efficient filters and economizer cycle.

**Post Office renovation, Cambridge, MA:** This historical 40,000 square foot building has been totally designed and renovated under “Green Building” criteria. This project is revolutionizing how the U.S. Post Office will design future buildings. The system consisted of high efficiency condensing type boilers, air-cooled liquid chillers, and air handlers with high efficient filters and economizer cycle.

**Office Building, Hanscom U.S. Air Force Base Bedford, MA:** Designed new HVAC system for an existing 50,000 square foot office building. The existing air handlers, ductwork, chilled water and



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## Frank Traknyak, P.E. RESUME

steam piping were demolished. Design included new air handling units, VAV boxes , and DDC controls.

**Parking Garage, New Britain, CT:** Designed HVAC systems associated with a courthouse parking garage. The project also included an enclosed pedestrian bridge, which was heated, cooled, and ventilated.

**Federal Courthouse, Bridgeport, CT:** Completed HVAC design renovations of the second floor of a federal courthouse in Bridgeport, Connecticut. Designed special filtration system utilizing HEPA filters to capture the asbestos fibers and prevent contamination of the newly renovated spaces and cross contamination with un-renovated adjacent spaces.

**TU Electric Office Tower, Dallas, TX:** Renovated mechanical systems serving the 25th floor and basement for TU Electric's Energy Plaza 46 story high rise office building. Produced all design documents and calculations for the new HVAC systems. The HVAC system was required to tie into the building's existing air handlers and energy management system.

**Diesel Fuel Oil System:** Designed a diesel fueling system for a diesel generator serving New York City high rise. It included two 6,000 gallon tanks and two 70 g.p.m. fuel pumps.

**Hanscom U.S. Air Force Base, MA:** Responsible for design of a 30,000 s.f. office building renovation. The design package involved a steam/chilled water HVAC system, plumbing, and fire protection. Assisted in completing a similar design package for a new 15,000 SQFT U.S. Air Force Band Center/Recording Studio. Performed heating and cooling load calculations for coil and air handling sizing; as well as pump and pipe sizing for chilled water and steam piping.

**Post Office/Courthouse, Boston, MA:** Provided feasibility study, conceptual design, equipment sizing, and cost estimates for the complete renovation of the HVAC system, plumbing, and fire protection of a 22 story building for GSA.

**General Services Administration (GSA):** The project also included smoke-venting systems of these machine rooms and elevator shafts in accordance with the local codes. Was also responsible for providing construction inspection and management services for the project. This was performed on a 22-story post office/court house building in downtown Boston.

**Computer Room, Hanscom AFB, MA:** Converted a metallurgy laboratory to a weather monitoring computer center at the Hanscom Air Force Base. Generated calculations, construction drawings and specifications for HVAC system with humidification to produce a computer room environment. The renovation also required upgrading the existing fire protection system. Was responsible for heating and cooling load calculations, as well as analysis for coil, air handling, and humidification system sizing.

**Aetna Insurance Co., Computer Headquarters:** Assisted in the engineering, design, and estimate of a central chilled water system, diesel cogeneration plant ventilation and exhaust gas system, and a UPS room HVAC system. Generated all heating and cooling load calculations and psychometric analysis for coil, air handling, and humidification system sizing. Also performed pressure drop



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calculations for chilled water pump and pipe sizing, and for the sizing of the exhaust piping and muffler of the cogeneration plant.

### Underground and Utility projects

**Geothermal System, Community College of Rhode Island, Warwick, RI:** This innovative project utilizes double condenser bundle high efficiency liquid chillers to heat and cool the building. Heat is rejected into the ground loop of the geothermal system in the summer and absorbed from the ground loop in the winter. Seventy ground loop bore holes as deep as 600 feet provides 500 tons for cooling and heating.

**Underground Steam Project, University of Rhode Island (URI), Kingston, RI:** Developed plans and specifications for routing of approximately 90 miles of new underground steam and condensate lines and condensate pumps for the entire campus. Pipe sizes ranged from 16 to 1 ½" pipe.

**Underground Steam Project, Bridgewater State Correctional facility, Bridgewater, MA:** Developed plans and specifications for routing of new underground steam and condensate branch lines serving the kitchen and dining building.

**Boston Thermal Steam Generating Plant, Boston, MA:** Engineered and designed a steam piping system conforming to ASTM B31.1, pressure reducing station, 3-stage pressure relief sized for 400,000 lb/hr stream at 300 PSI.

**Underground Steam Condensate Project:** Over 1200 feet of underground steam condensate piping was installed utilizing pre-engineered piping system. The project also consisted replacing all power plant boiler pressure relief valves that served the Worcester State Hospital.

### Industrial and Process Projects:

**Corps of Engineers and Navy at the Corpus Christi Navel Air Station:** Worked on a paint spray facility to paint various military helicopters. The project includes 2 facilities 1) an existing facility with four paint spray booths each with a water wash anti-filtration system and 2) a new paint facility consisting of 2 large paint spray booths with a dry paint filtration system. Each facility has a total of 800,000-cfm make up air to replace the air exhausted from the booths. Responsible for the design of the fire protection, mechanical systems and plumbing for booth of these facilities. Also currently in the cost estimate phase of the project.

The new Paint spray booth facility will be a new structure with new equipment, fire protection and mechanical HVAC equipment. The existing facility's paint spray booth needs to be converted from a wet paint filtration system to a dry filter system. The mechanical systems will be brought up to codes per NAPA 33, OSHA standards and military standards.

Common to booth facilities is a new chilled water plant and a new steam supply system. The chilled water system will be approximately 2,400 tons of cooling, and consist of new chillers, chilled water pumps, cooling towers, and appurtenances. The steam supply will be a new steam line capable of handling 30,000 lbs/hr of steam fed from base's steam plant.



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Frank Traknyak, P.E. RESUME

**Northrop Grumman, Dallas, TX:** Completed a 14,000 SQFT paint spray/clean room facility to paint various aircraft parts. The project consisted of renovating the East end of an existing facility to house three new paint spray booths in a clean room environment. A regenerative thermal oxidizer (RTO) on the air exhaust system was required to eliminate a minimum of 98% of VOCs from escaping into the atmosphere. The project also included the full design of a new fire protection suppression and fire alarm system. Responsible for the design of the fire protection, mechanical, controls, compressed air, breathing air and plumbing systems. Produced design drawings, specifications, and generated all calculations for the project. Led a team of 5 designers to complete the project.

The total make up air for the paint spray booths was 47,500 cfm. The RTO and exhaust system totaled 50,000 cfm. The makeup air units (MAU) required new chilled water, cooling tower condenser water, and steam supply and return piping. This piping will be tied into an existing central plant located across the street via an overhead pipe bridge. The control system controls the MAU and RTO fans (to ensure a negative pressure in the spray room and in the air locks), the coils in the MAU, and interlock the RTO, MAU, compressed air system, with the fire alarm system to shut down all equipment.

**Aviation Fueling Facility, Army Corps of Engineers, Fort Hood, TX:** Worked on two-aviation jet fueling projects. Each project consisted of bulk storage tanks totaling 300,000 gallons, 3 on-loading and 3 off-loading pumps 300 g.p.m. each. The project included a fuel piping system, leak detection system, dike storm water system, fuel tank AFFF fire protection systems, and 3,000 feet of 8 inch underground water supply system with fire hydrants. Responsible for the design of the fuel system design, fire protection, civil, leak detection and control systems. Produced design drawings, specifications, and generated all calculations for the project. Led a team of 3 designers to complete the project. This project was performed for the Army Corps of Engineers.

**Keys Fiber Paper Mill:** Performed a flow and material balance for 340,000 SQFT paper mill company. Made flow measurements of water and paper slurry to reduce water consumption, identify problems and streamline process. Solutions proposed to the client saved over \$1000/day for only \$2000 in modifications.

**Waste Water Treatment Projects:** Responsible for designing HVAC systems for waste water treatment and composting facilities. Responsibilities included engineering and design of heat recovery systems to heat building utilizing energy from process; ventilation and exhaust system for odor control and toxic gas removal; and pressure blower system for composting process;

**EXPERT STATEMENT OF DAN SHARP, AIA**

1. My name is Dan Sharp. I am a licensed architect actively engaged in the practice of architecture in the State of Texas. A true and correct copy of my CV, attached as Appendix B-4, summarizes my relevant qualifications including professional education, certifications, membership in professional associations and experience. I am a Registered Architect in Texas (#5266) and have been licensed in Texas for 42 years.
2. I am a Senior Project Manager with PDG Architects, a full-service architectural firm founded in 1982 that provides complete planning, design and documentation services, to a diverse group of clients across the public and private sectors. The firm employs a staff of 36 and is headquartered in Houston, Texas.
3. I have worked for many years in the planning, design, and construction of many building types. The last 20 years has focused on the investigation of deficiencies and failures (forensics) of building systems and how they impact the overall building. I have knowledge and experience with the design, components, characteristics, and operation of climate control systems. I am familiar with MEP specs, energy audits, due diligence reports and other applications of regulations and industry standards to building and construction.
4. Before coming to PDG, I was the Director of Planning and Design, for Private Mini Storage, Houston from 1997-2000 and was a Senior Project Manager, at Chelsea Architects, in Houston from 1991-1997.
5. Trak Engineering, Inc. and PDG Architects (the "TRAK/PDG Team") was tasked with drafting a construction management plan for air conditioning the Hutchins State Jail. My opinions and conclusions are contained in the Hutchins State Jail Study of Indoor Climate Control Modifications ("Hutchins Study").
6. In drafting the Hutchins Study, I relied on several documents, as listed below:
  - a. Documents contained in Section 6 – Bibliography, of the Hutchins Study;
  - b. NWS weather data from Ferris Station in Ferris, Texas and Lancaster Airport, Lancaster, Texas
  - c. Temperature and humidity data logged inside the Hutchins State Jail from August 25 to October 8, 2014;
  - d. On-site visits and observations of the Hutchins State Jail;
  - e. Blueprints of the Hutchins State Jail.
7. The TRAK/PDG Team has been paid a total of \$117,455.00 to draft four (4) Indoor Climate Control Modifications Studies, including a study for the Pack Unit, the Hutchins State Jail, the Michael Unit and the Coffield Unit. The Team was paid \$5,000.00 for installation of temperature and humidity sensors in the each of those Units. My individual time is billed at \$250.00 per hour.

Signed:



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DAN SHARP, AIA

## Dan M. Sharp, AIA

713-629-6100

3100 Weslayan, Suite 200, Houston, TX 77027

dsharp@pdgarchitects.com

### Professional Profile

- Registered Architect Specializing in the Technical Practice of Architecture
- Forensics
  - Laboratories & Control Rooms
  - Construction Manager
  - Physical Condition Surveys
  - Site Development
  - Feasibility Studies

### Professional Accomplishments

- Project Development
- Developed 10 Million SF of Regional Shopping Centers, 1975-1981
  - Operated Over 100 Ltd. Partnership Development Entities, 1981 - 1991
  - Developed 26 Self Storage Facilities in Six States, 1997-2001

Renovation & Alteration Technical Development

- Renovated 30 Elementary & Middle Schools, Houston, TX
- Conducted Multiple Feasibility Studies for GSA Region 7
- Managed Infrastructure Design & Construction for Petro Chemical Facilities
- Specialty in Building Envelope Design and Construction

Diversified Geographic Experience

- Design & Construction in 15 US States
- Design & Construction in 5 Foreign Countries

### Work History

#### 1969 - 1972

1Lt, Instructor, US Army Engineer School, Fort Belvoir, VA

#### 1972 - 1975

Construction Administrator, KTC Architects, Houston, TX

#### 1975 - 1981

Director Planning & Design, Paul Broadhead & Assoc., Meridian, MS

#### 1981 - 1991

Partner, Pacer Development Corporation, Houston, TX

#### 1991 - 1997

Senior Project Manager, Chelsea Architects, Houston, TX

#### 1997 - 2000

Director Planning & Design, Private Mini Storage, Houston, TX

#### 2000 - 2015

Senior Project Manager, PDG Architects, Houston, TX

### Education

Bachelor of Architecture - 1969

University of Texas School of Architecture, Austin, TX

**Recent Studies and Assessments**

U.S. General Services Administration – Tyler Federal Courthouse Forensic Study, Tyler, Texas  
U.S. General Services Administration – O.C. Fisher Federal Office Building Forensic study, San Angelo, Texas  
U.S. General Services Administration – Mickey Leland Federal Office Building Structural Forensic Study, Houston, Texas  
U.S. General Services Administration – J.J. Pickle Federal Office Building Condition Survey, Austin, Texas  
U.S. General Services Administration – J.J. Pickle Federal Office Building Blast Prevention Study, Austin, Texas  
U.S. General Services Administration – Galveston Federal Courthouse & Post Office Hurricane Recovery study, Galveston, Texas  
U.S. General Services Administration – Region 7 Physical Condition Survey for 286 Building Inventory, Texas, New Mexico, Louisiana, Arkansas, Oklahoma.  
U.S. General Services Administration – IRS Service Centers, Texas, Louisiana & Arkansas University of Houston – Feasibility Study for Oberholtzer Hall Replacement, Houston, Texas  
NASA - Neutral Buoyancy Lab Structural Forensic Study – LBJ Space Center, Houston, Texas  
BASF – GCP Lab Feasibility Study, Houston, Texas  
BASF – Polycaprolactam Strand Room Renovation Study, Freeport, Texas  
CCVI – Multiple Facility Physical Condition Survey and Feasibility Studies, Guatemala, CA

## Appendix B-5

### Calculation Data

**Trak Engineering, Inc.**

TDCJ HUTCHINS UNIT

Dallas, Texas

Project G1400100

Dallas, Texas

Longitude 97.04 W

Latitude 32.90 N

Design Criteria From 2013 ASHRAE Fundamentals Handbook

Use:

Dallas, Texas

Longitude 97.04 W

Latitude 32.90 N

Altitude 597 ft

## Outdoor Temperatures

Summer	100.5 DB 78.6 WB	0.40%
Winter	23.0 DB	99.60%

## Indoor Temperatures

Summer	80 DB 63.5 WB	40%RH
--------	---------------	-------

Space	Area	
Dorm Unit A-C	7879.8	
Corridor	200	
	<hr/> 8079.8	

## Building Envelop Design Values

	R-Value	U-Value	Shade Coefficient
Walls=	11.07	0.09	
Roof=	5.00	0.20	
Single Pane Glass	--	1.04	0.80
Doors=	--	0.46	
Doors with Glass =		0.46	
Glass in Doors =	--	1.04	0.80
Skylights =	--	0.80	0.57

Cooling Load

**Plant Sizing Summary for HUTCHINS**

G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.

01/28/2015  
08:27AM

**1. Plant Information:**

Plant Name ..... **HUTCHINS**  
Plant Type ..... **Chiller Plant**  
Design Weather ..... **Dallas, Texas**

**2. Cooling Plant Sizing Data:**

Maximum Plant Load ..... **458.3** Tons  
Load occurs at ..... **Jul 1500**  
ft<sup>2</sup>/Ton ..... **330.8** ft<sup>2</sup>/Ton  
Floor area served by plant ..... **151587.0** ft<sup>2</sup>

**3. Coincident Cooling Loads for Jul 1500**

Air System Name	Mult.	System Cooling Coil Load ( Tons )
AC-A	1	101.1
AC-B	2	101.1
AC-D	1	52.2
AC-E	2	51.4

Air system loads are for coils whose cooling source is ' Chilled Water ' .

**Air System Information**

Air System Name .....	<b>AC-A</b>	Number of zones .....	<b>1</b>
Equipment Class .....	<b>CW AHU</b>	Floor Area .....	<b>33686.0</b> ft <sup>2</sup>
Air System Type .....	<b>SZCAV</b>	Location .....	<b>Dallas, Texas</b>

**Sizing Calculation Information**

Calculation Months .....	<b>Jan to Dec</b>	Zone CFM Sizing .....	<b>Sum of space airflow rates</b>
Sizing Data .....	<b>Calculated</b>	Space CFM Sizing .....	<b>Individual peak space loads</b>

**Central Cooling Coil Sizing Data**

Total coil load .....	<b>101.1</b> Tons	Load occurs at .....	<b>Jul 1500</b>
Total coil load .....	<b>1212.7</b> MBH	OA DB / WB .....	<b>100.5 / 78.6</b> °F
Sensible coil load .....	<b>931.5</b> MBH	Entering DB / WB .....	<b>83.5 / 66.5</b> °F
Coil CFM at Jul 1500 .....	<b>29929</b> CFM	Leaving DB / WB .....	<b>54.0 / 52.6</b> °F
Max block CFM .....	<b>29929</b> CFM	Coil ADP .....	<b>50.8</b> °F
Sum of peak zone CFM .....	<b>29929</b> CFM	Bypass Factor .....	<b>0.100</b>
Sensible heat ratio .....	<b>0.768</b>	Resulting RH .....	<b>39</b> %
ft <sup>2</sup> /Ton .....	<b>333.3</b>	Design supply temp. ....	<b>55.0</b> °F
BTU/(hr-ft <sup>2</sup> ) .....	<b>36.0</b>	Zone T-stat Check .....	<b>0 of 1</b> OK
Water flow @ 16.0 °F rise .....	<b>151.67</b> gpm	Max zone temperature deviation .....	<b>0.2</b> °F

**Supply Fan Sizing Data**

Actual max CFM .....	<b>29929</b> CFM	Fan motor BHP .....	<b>16.39</b> BHP
Standard CFM .....	<b>29289</b> CFM	Fan motor kW .....	<b>13.00</b> kW
Actual max CFM/ft <sup>2</sup> .....	<b>0.89</b> CFM/ft <sup>2</sup>	Fan static .....	<b>2.00</b> in wg

**Outdoor Ventilation Air Data**

Design airflow CFM .....	<b>6202</b> CFM	CFM/person .....	<b>14.36</b> CFM/person
CFM/ft <sup>2</sup> .....	<b>0.18</b> CFM/ft <sup>2</sup>		

**Zone Sizing Summary for AC-A**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:35AM

**Air System Information**

Air System Name .....	AC-A	Number of zones .....	1
Equipment Class .....	CW AHU	Floor Area .....	33686.0 ft <sup>2</sup>
Air System Type .....	SZCAV	Location .....	Dallas, Texas

**Sizing Calculation Information**

Calculation Months .....	Jan to Dec	Zone CFM Sizing .....	Sum of space airflow rates
Sizing Data .....	Calculated	Space CFM Sizing .....	Individual peak space loads

**Zone Sizing Data**

Zone Name	Maximum Cooling Sensible (MBH)	Design Airflow (CFM)	Minimum Airflow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft <sup>2</sup> )	Zone CFM/ft <sup>2</sup>
Zone 1	751.3	28433	28433	Jul 1400	620.0	33686.0	0.84

**Zone Terminal Sizing Data**

No Zone Terminal Sizing Data required for this system.

**Space Loads and Airflows**

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft <sup>2</sup> )	Space CFM/ft <sup>2</sup>
<b>Zone 1</b>							
A 8 DORMS	1	751.3	Jul 1400	28433	620.0	33686.0	0.84

**Air System Design Load Summary for AC-A**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:35AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 100.5 °F / 78.6 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F		
	ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)
Window & Skylight Solar Loads	1024 ft <sup>2</sup>	53443	-	1024 ft <sup>2</sup>	-	-
Wall Transmission	9145 ft <sup>2</sup>	22838	-	9145 ft <sup>2</sup>	46290	-
Roof Transmission	36116 ft <sup>2</sup>	107875	-	36116 ft <sup>2</sup>	382803	-
Window Transmission	640 ft <sup>2</sup>	11165	-	640 ft <sup>2</sup>	35277	-
Skylight Transmission	384 ft <sup>2</sup>	5153	-	384 ft <sup>2</sup>	16282	-
Door Loads	504 ft <sup>2</sup>	4458	-	504 ft <sup>2</sup>	12656	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	1728 ft <sup>2</sup>	6643	-	1728 ft <sup>2</sup>	18144	-
Ceiling	4968 ft <sup>2</sup>	19100	-	4968 ft <sup>2</sup>	52164	-
Overhead Lighting	48508 W	165506	-	0	0	-
Task Lighting	50529 W	172402	-	0	0	-
Electric Equipment	4050 W	13819	-	0	0	-
People	432	99359	51840	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	68176	2592	10%	56362	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>749936</b>	<b>54432</b>	<b>-</b>	<b>619977</b>	<b>0</b>
Zone Conditioning	-	738946	54432	-	-46332	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	29929 CFM	0	-	29929 CFM	0	-
Ventilation Load	6202 CFM	140697	226826	6202 CFM	84781	0
Supply Fan Load	29929 CFM	44374	-	29929 CFM	-44374	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	1%	7499	-	1%	6200	-
<b>&gt;&gt; Total System Loads</b>	<b>-</b>	<b>931517</b>	<b>281258</b>	<b>-</b>	<b>274</b>	<b>0</b>
Central Cooling Coil	-	931517	281232	-	0	0
<b>&gt;&gt; Total Conditioning</b>	<b>-</b>	<b>931517</b>	<b>281232</b>	<b>-</b>	<b>0</b>	<b>0</b>
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

**Space Design Load Summary for AC-A**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:35AM

**TABLE 1.1.A. COMPONENT LOADS FOR SPACE "A 8 DORMS" IN ZONE "Zone 1"**

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400		HEATING DATA AT DES HTG			
	COOLING OA DB / WB 99.9 °F / 78.3 °F		HEATING OA DB / WB 17.0 °F / 13.9 °F			
		Sensible	Latent		Sensible	Latent
<b>SPACE LOADS</b>	<b>Details</b>	(BTU/hr)	(BTU/hr)	<b>Details</b>	(BTU/hr)	(BTU/hr)
Window & Skylight Solar Loads	1024 ft <sup>2</sup>	51204	-	1024 ft <sup>2</sup>	-	-
Wall Transmission	9145 ft <sup>2</sup>	21094	-	9145 ft <sup>2</sup>	46290	-
Roof Transmission	36116 ft <sup>2</sup>	114204	-	36116 ft <sup>2</sup>	382803	-
Window Transmission	640 ft <sup>2</sup>	10717	-	640 ft <sup>2</sup>	35277	-
Skylight Transmission	384 ft <sup>2</sup>	4946	-	384 ft <sup>2</sup>	16282	-
Door Loads	504 ft <sup>2</sup>	4248	-	504 ft <sup>2</sup>	12656	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	1728 ft <sup>2</sup>	6575	-	1728 ft <sup>2</sup>	18144	-
Ceiling	4968 ft <sup>2</sup>	18902	-	4968 ft <sup>2</sup>	52164	-
Overhead Lighting	48508 W	165506	-	0	0	-
Task Lighting	50529 W	172402	-	0	0	-
Electric Equipment	4050 W	13819	-	0	0	-
People	432	99359	51840	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	68297	2592	10%	56362	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>751272</b>	<b>54432</b>	<b>-</b>	<b>619977</b>	<b>0</b>

**TABLE 1.1.B. ENVELOPE LOADS FOR SPACE "A 8 DORMS" IN ZONE "Zone 1"**

	Area (ft <sup>2</sup> )	U-Value (BTU/(hr-ft <sup>2</sup> -°F))	Shade Coeff.	COOLING	COOLING	HEATING
				TRANS	SOLAR	TRANS
<b>NW EXPOSURE</b>						
WALL	2756	0.096	-	6528	-	13950
WINDOW 1	288	1.040	0.800	4823	8369	15875
DOOR	196	0.460	-	1452	-	4778
<b>SE EXPOSURE</b>						
WALL	2853	0.096	-	5906	-	14441
WINDOW 1	288	1.040	0.800	4823	10983	15875
DOOR	252	0.460	-	1866	-	6144
<b>NE EXPOSURE</b>						
WALL	1768	0.096	-	3603	-	8949
WINDOW 1	32	1.040	0.800	536	1116	1764
<b>SW EXPOSURE</b>						
WALL	1768	0.096	-	5057	-	8949
WINDOW 1	32	1.040	0.800	536	1345	1764
<b>NW EXPOSURE</b>						
DOOR	22	0.460	-	163	-	536
DOOR GLASS	6	1.040	0.800	100	174	331
<b>SE EXPOSURE</b>						
DOOR	22	0.460	-	163	-	536
DOOR GLASS	6	1.040	0.800	100	229	331
<b>H EXPOSURE</b>						
ROOF	36116	0.200	-	114204	-	382803
SKYLIGHT	384	0.800	0.570	4946	29392	16282

**System Psychrometrics for AC-A**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:35AM

**July DESIGN COOLING DAY, 1500****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	100.5	0.01651	6202	400	140697	226826
Vent - Return Mixing	Outlet	83.5	0.01027	29929	879	-	-
Central Cooling Coil	Outlet	54.0	0.00825	29929	879	931517	281232
Supply Fan	Outlet	55.4	0.00825	29929	879	44374	-
Cold Supply Duct	Outlet	55.7	0.00825	28433	879	-	-
Zone Air	-	80.3	0.00866	28433	1012	738946	54432
Return Plenum	Outlet	80.3	0.00866	28433	1012	0	-
Duct Leakage Air	Outlet	55.4	0.00825	1496	879	-	-
Return Duct	Outlet	79.0	0.00864	29929	1004	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	749936	Cooling	738946	80.3	28433	1012	0	0

**System Psychrometrics for AC-A**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:35AM

**WINTER DESIGN HEATING****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	17.0	0.00094	6202	400	-84781	0
Vent - Return Mixing	Outlet	27.3	0.00094	29929	431	-	-
Central Cooling Coil	Outlet	27.3	0.00094	29929	431	0	0
Supply Fan	Outlet	28.7	0.00094	29929	431	44374	-
Cold Supply Duct	Outlet	28.5	0.00094	28433	431	-	-
Zone Air	-	30.0	0.00094	28433	439	46332	0
Return Plenum	Outlet	30.0	0.00094	28433	439	0	-
Duct Leakage Air	Outlet	28.7	0.00094	1496	431	-	-
Return Duct	Outlet	29.9	0.00094	29929	439	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	-619977	Deadband	46332	30.0	28433	439	0	0

**Psychrometric Analysis for AC-A**

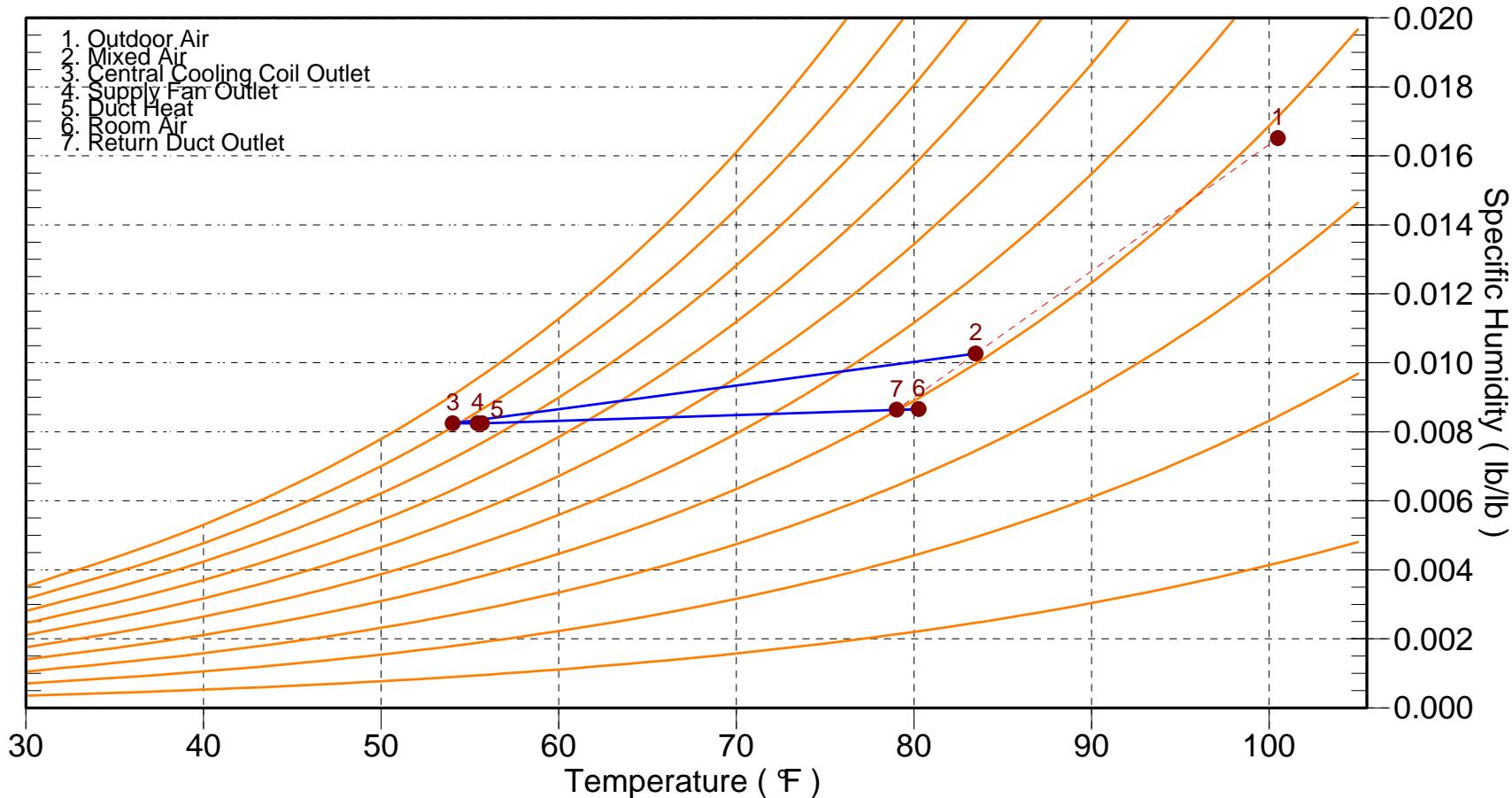
Project Name: G1400100 TDCJ Hutchins Unit Block Load  
Prepared by: Trak Engineering, Inc.

01/28/2015  
08:35AM

Location: Dallas, Texas

Altitude: 597.0 ft.

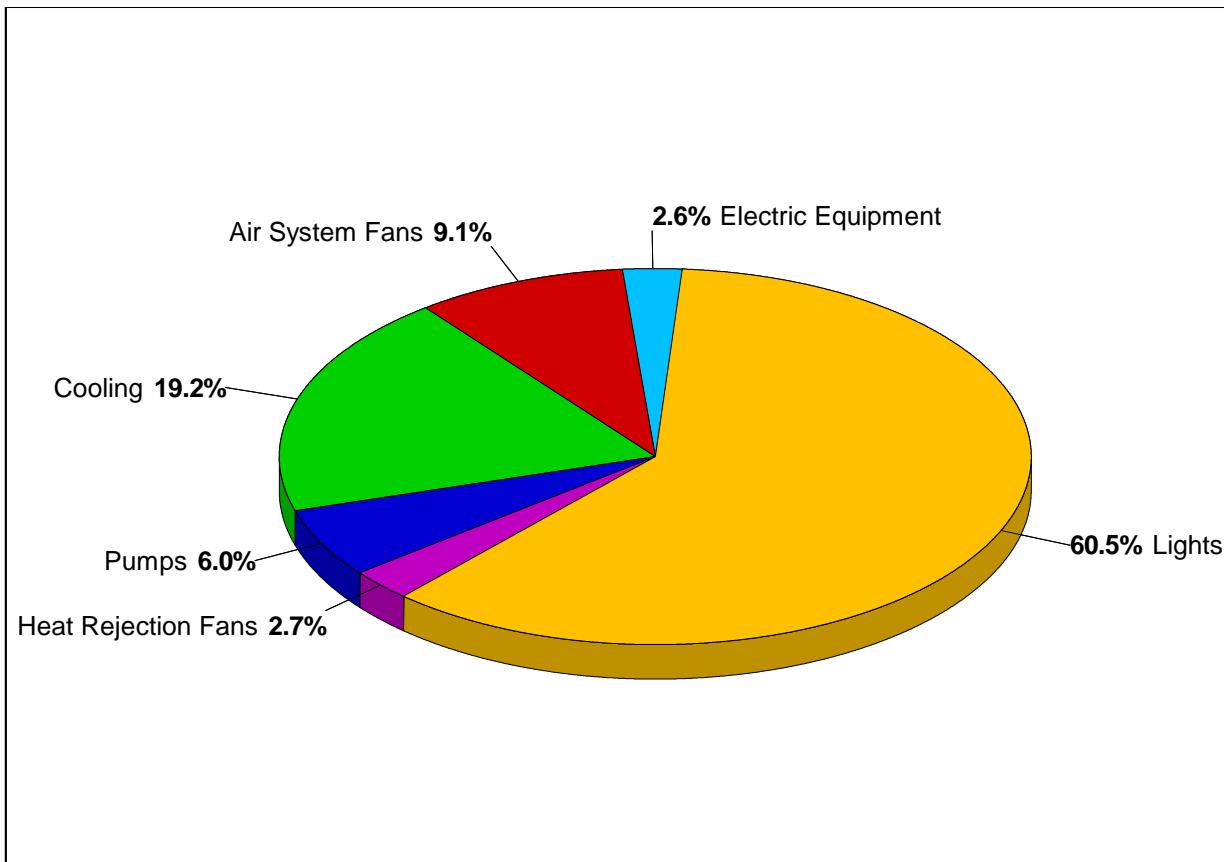
Data for: July DESIGN COOLING DAY, 1500



**Annual Component Costs - HUTCHINS UNIT WITH CHILLER PLANT**

G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.

07/14/2015  
04:12PM

**1. Annual Costs**

Component	Annual Cost (\$)	(\$/ft <sup>2</sup> )	Percent of Total (%)
Air System Fans	29,267	0.193	9.1
Cooling	61,899	0.408	19.2
Heating	0	0.000	0.0
Pumps	19,262	0.127	6.0
Heat Rejection Fans	8,714	0.058	2.7
<b>HVAC Sub-Total</b>	<b>119,141</b>	<b>0.786</b>	<b>36.9</b>
Lights	195,198	1.288	60.5
Electric Equipment	8,278	0.055	2.6
Misc. Electric	0	0.000	0.0
Misc. Fuel Use	0	0.000	0.0
<b>Non-HVAC Sub-Total</b>	<b>203,477</b>	<b>1.342</b>	<b>63.1</b>
<b>Grand Total</b>	<b>322,618</b>	<b>2.128</b>	<b>100.0</b>

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... 151587.0 ft<sup>2</sup>  
Conditioned Floor Area ..... 151587.0 ft<sup>2</sup>

**Hourly Use Profiles - Electric - HUTCHINS UNIT WITH CHILLER PLANT**G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.07/14/2015  
04:12PM

Hour	Wednesday Jan 1 (kW)
0000	531.4
0100	531.4
0200	531.4
0300	531.4
0400	531.4
0500	531.4
0600	531.4
0700	531.4
0800	531.4
0900	531.4
1000	531.4
1100	531.4
1200	531.4
1300	531.4
1400	531.4
1500	531.4
1600	531.4
1700	531.4
1800	531.4
1900	531.4
2000	531.4
2100	531.4
2200	531.4
2300	531.4

**Annual Cost Summary**

G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.

07/14/2015  
04:10PM

**Table 1. Annual Costs**

<b>Component</b>	<b>HUTCHINS UNIT WITH CHILLER PLANT (\$)</b>
Air System Fans	29,267
Cooling	61,899
Heating	0
Pumps	19,262
Heat Rejection Fans	8,714
<b>HVAC Sub-Total</b>	<b>119,141</b>
Lights	195,198
Electric Equipment	8,278
Misc. Electric	0
Misc. Fuel Use	0
<b>Non-HVAC Sub-Total</b>	<b>203,477</b>
<b>Grand Total</b>	<b>322,618</b>

**Table 2. Annual Cost per Unit Floor Area**

<b>Component</b>	<b>HUTCHINS UNIT WITH CHILLER PLANT (\$/ft<sup>2</sup>)</b>
Air System Fans	0.193
Cooling	0.408
Heating	0.000
Pumps	0.127
Heat Rejection Fans	0.058
<b>HVAC Sub-Total</b>	<b>0.786</b>
Lights	1.288
Electric Equipment	0.055
Misc. Electric	0.000
Misc. Fuel Use	0.000
<b>Non-HVAC Sub-Total</b>	<b>1.342</b>
<b>Grand Total</b>	<b>2.128</b>
Gross Floor Area (ft <sup>2</sup> )	151587.0
Conditioned Floor Area (ft <sup>2</sup> )	151587.0

Note: Values in this table are calculated using the Gross Floor Area.

**Annual Cost Summary**

G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.

07/14/2015  
04:10PM

**Table 3. Component Cost as a Percentage of Total Cost**

<b>Component</b>	<b>HUTCHINS UNIT WITH CHILLER PLANT (%)</b>
Air System Fans	9.1
Cooling	19.2
Heating	0.0
Pumps	6.0
Heat Rejection Fans	2.7
<b>HVAC Sub-Total</b>	<b>36.9</b>
Lights	60.5
Electric Equipment	2.6
Misc. Electric	0.0
Misc. Fuel Use	0.0
<b>Non-HVAC Sub-Total</b>	<b>63.1</b>
<b>Grand Total</b>	<b>100.0</b>

**Hourly Use Profiles - Electric - HUTCHINS UNIT WITH CHILLER PLANT**G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.07/14/2015  
04:10PM

Hour	Wednesday Jan 1 (kW)
0000	531.4
0100	531.4
0200	531.4
0300	531.4
0400	531.4
0500	531.4
0600	531.4
0700	531.4
0800	531.4
0900	531.4
1000	531.4
1100	531.4
1200	531.4
1300	531.4
1400	531.4
1500	531.4
1600	531.4
1700	531.4
1800	531.4
1900	531.4
2000	531.4
2100	531.4
2200	531.4
2300	531.4

**Air System Sizing Summary for AC-B**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

**Air System Information**

Air System Name ..... **AC-B**  
 Equipment Class ..... **CW AHU**  
 Air System Type ..... **SZCAV**

Number of zones ..... **1**  
 Floor Area ..... **33686.0 ft<sup>2</sup>**  
 Location ..... **Dallas, Texas**

**Sizing Calculation Information**

Calculation Months ..... **Jan to Dec**  
 Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**  
 Space CFM Sizing ..... **Individual peak space loads**

**Central Cooling Coil Sizing Data**

Total coil load ..... **101.1** Tons  
 Total coil load ..... **1213.2** MBH  
 Sensible coil load ..... **931.8** MBH  
 Coil CFM at Jul 1500 ..... **29931** CFM  
 Max block CFM ..... **29931** CFM  
 Sum of peak zone CFM ..... **29931** CFM  
 Sensible heat ratio ..... **0.768**  
 ft<sup>2</sup>/Ton ..... **333.2**  
 BTU/(hr-ft<sup>2</sup>) ..... **36.0**  
 Water flow @ 16.0 °F rise ..... **151.73** gpm

Load occurs at ..... **Jul 1500**  
 OA DB / WB ..... **100.5 / 78.6** °F  
 Entering DB / WB ..... **83.5 / 66.5** °F  
 Leaving DB / WB ..... **54.0 / 52.6** °F  
 Coil ADP ..... **50.8** °F  
 Bypass Factor ..... **0.100**  
 Resulting RH ..... **39** %  
 Design supply temp. ..... **55.0** °F  
 Zone T-stat Check ..... **0 of 1** OK  
 Max zone temperature deviation ..... **0.2** °F

**Supply Fan Sizing Data**

Actual max CFM ..... **29931** CFM  
 Standard CFM ..... **29291** CFM  
 Actual max CFM/ft<sup>2</sup> ..... **0.89** CFM/ft<sup>2</sup>

Fan motor BHP ..... **16.39** BHP  
 Fan motor kW ..... **13.01** kW  
 Fan static ..... **2.00** in wg

**Outdoor Ventilation Air Data**

Design airflow CFM ..... **6202** CFM  
 CFM/ft<sup>2</sup> ..... **0.18** CFM/ft<sup>2</sup>

CFM/person ..... **14.36** CFM/person

**Zone Sizing Summary for AC-B**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

**Air System Information**

Air System Name ..... **AC-B**  
 Equipment Class ..... **CW AHU**  
 Air System Type ..... **SZCAV**

Number of zones ..... **1**  
 Floor Area ..... **33686.0 ft<sup>2</sup>**  
 Location ..... **Dallas, Texas**

**Sizing Calculation Information**

Calculation Months .....	<b>Jan to Dec</b>	Zone CFM Sizing .....	<b>Sum of space airflow rates</b>
Sizing Data .....	<b>Calculated</b>	Space CFM Sizing .....	<b>Individual peak space loads</b>

**Zone Sizing Data**

Zone Name	Maximum Cooling Sensible (MBH)	Design Airflow (CFM)	Minimum Airflow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft <sup>2</sup> )	Zone CFM/ft <sup>2</sup>
Zone 1	751.3	28434	28434	Jul 1400	620.0	33686.0	0.84

**Zone Terminal Sizing Data**

No Zone Terminal Sizing Data required for this system.

**Space Loads and Airflows**

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft <sup>2</sup> )	Space CFM/ft <sup>2</sup>
<b>Zone 1</b>							
B and C DORMS	1	751.3	Jul 1400	28434	620.0	33686.0	0.84

**Air System Design Load Summary for AC-B**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 100.5 °F / 78.6 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F		
	ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)
Window & Skylight Solar Loads	1024 ft <sup>2</sup>	53443	-	1024 ft <sup>2</sup>	-	-
Wall Transmission	9145 ft <sup>2</sup>	22906	-	9145 ft <sup>2</sup>	46290	-
Roof Transmission	36116 ft <sup>2</sup>	107875	-	36116 ft <sup>2</sup>	382803	-
Window Transmission	640 ft <sup>2</sup>	11165	-	640 ft <sup>2</sup>	35277	-
Skylight Transmission	384 ft <sup>2</sup>	5153	-	384 ft <sup>2</sup>	16282	-
Door Loads	504 ft <sup>2</sup>	4458	-	504 ft <sup>2</sup>	12656	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	1728 ft <sup>2</sup>	6643	-	1728 ft <sup>2</sup>	18144	-
Ceiling	4968 ft <sup>2</sup>	19100	-	4968 ft <sup>2</sup>	52164	-
Overhead Lighting	48508 W	165506	-	0	0	-
Task Lighting	50529 W	172402	-	0	0	-
Electric Equipment	4050 W	13819	-	0	0	-
People	432	99359	51840	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	68183	2592	10%	56362	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>750010</b>	<b>54432</b>	<b>-</b>	<b>619977</b>	<b>0</b>
Zone Conditioning	-	739237	54432	-	-46330	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	29931 CFM	0	-	29931 CFM	0	-
Ventilation Load	6202 CFM	140720	226934	6202 CFM	84781	0
Supply Fan Load	29931 CFM	44376	-	29931 CFM	-44376	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	1%	7500	-	1%	6200	-
<b>&gt;&gt; Total System Loads</b>	<b>-</b>	<b>931834</b>	<b>281366</b>	<b>-</b>	<b>274</b>	<b>0</b>
Central Cooling Coil	-	931834	281344	-	0	0
<b>&gt;&gt; Total Conditioning</b>	<b>-</b>	<b>931834</b>	<b>281344</b>	<b>-</b>	<b>0</b>	<b>0</b>
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

**Space Design Load Summary for AC-B**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

**TABLE 1.1.A. COMPONENT LOADS FOR SPACE "B and C DORMS" IN ZONE "Zone 1"**

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 99.9 °F / 78.3 °F OCCUPIED T-STAT 80.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F OCCUPIED T-STAT 70.0 °F		
SPACE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	1024 ft <sup>2</sup>	51204	-	1024 ft <sup>2</sup>	-	-
Wall Transmission	9145 ft <sup>2</sup>	21123	-	9145 ft <sup>2</sup>	46290	-
Roof Transmission	36116 ft <sup>2</sup>	114204	-	36116 ft <sup>2</sup>	382803	-
Window Transmission	640 ft <sup>2</sup>	10717	-	640 ft <sup>2</sup>	35277	-
Skylight Transmission	384 ft <sup>2</sup>	4946	-	384 ft <sup>2</sup>	16282	-
Door Loads	504 ft <sup>2</sup>	4248	-	504 ft <sup>2</sup>	12656	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	1728 ft <sup>2</sup>	6575	-	1728 ft <sup>2</sup>	18144	-
Ceiling	4968 ft <sup>2</sup>	18902	-	4968 ft <sup>2</sup>	52164	-
Overhead Lighting	48508 W	165506	-	0	0	-
Task Lighting	50529 W	172402	-	0	0	-
Electric Equipment	4050 W	13819	-	0	0	-
People	432	99359	51840	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	68300	2592	10%	56362	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>751304</b>	<b>54432</b>	<b>-</b>	<b>619977</b>	<b>0</b>

**TABLE 1.1.B. ENVELOPE LOADS FOR SPACE "B and C DORMS" IN ZONE "Zone 1"**

	Area (ft <sup>2</sup> )	U-Value (BTU/(hr-ft <sup>2</sup> -°F))	Shade Coeff.	COOLING		HEATING (BTU/hr)
				TRANS	SOLAR	
<b>SE EXPOSURE</b>						
WALL	2756	0.096	-	5705	-	13950
WINDOW 1	288	1.040	0.800	4823	10983	15875
DOOR	196	0.460	-	1452	-	4778
<b>NW EXPOSURE</b>						
WALL	2853	0.096	-	6758	-	14441
WINDOW 1	288	1.040	0.800	4823	8369	15875
DOOR	252	0.460	-	1866	-	6144
<b>SW EXPOSURE</b>						
WALL	1768	0.096	-	5057	-	8949
WINDOW 1	32	1.040	0.800	536	1345	1764
<b>NE EXPOSURE</b>						
WALL	1768	0.096	-	3603	-	8949
WINDOW 1	32	1.040	0.800	536	1116	1764
<b>SE EXPOSURE</b>						
DOOR	22	0.460	-	163	-	536
DOOR GLASS	6	1.040	0.800	100	229	331
<b>NW EXPOSURE</b>						
DOOR	22	0.460	-	163	-	536
DOOR GLASS	6	1.040	0.800	100	174	331
<b>H EXPOSURE</b>						
ROOF	36116	0.200	-	114204	-	382803
SKYLIGHT	384	0.800	0.570	4946	29392	16282

**System Psychrometrics for AC-B**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

**July DESIGN COOLING DAY, 1500****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	100.5	0.01651	6202	400	140720	226934
Vent - Return Mixing	Outlet	83.5	0.01027	29931	879	-	-
Central Cooling Coil	Outlet	54.0	0.00824	29931	879	931834	281344
Supply Fan	Outlet	55.4	0.00824	29931	879	44376	-
Cold Supply Duct	Outlet	55.7	0.00824	28434	879	-	-
Zone Air	-	80.3	0.00865	28434	1011	739237	54432
Return Plenum	Outlet	80.3	0.00865	28434	1011	0	-
Duct Leakage Air	Outlet	55.4	0.00824	1497	879	-	-
Return Duct	Outlet	79.0	0.00863	29931	1004	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	750010	Cooling	739237	80.3	28434	1011	0	0

**System Psychrometrics for AC-B**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

**WINTER DESIGN HEATING****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	17.0	0.00094	6202	400	-84781	0
Vent - Return Mixing	Outlet	27.3	0.00094	29931	431	-	-
Central Cooling Coil	Outlet	27.3	0.00094	29931	431	0	0
Supply Fan	Outlet	28.7	0.00094	29931	431	44376	-
Cold Supply Duct	Outlet	28.5	0.00094	28434	431	-	-
Zone Air	-	30.0	0.00094	28434	439	46330	0
Return Plenum	Outlet	30.0	0.00094	28434	439	0	-
Duct Leakage Air	Outlet	28.7	0.00094	1497	431	-	-
Return Duct	Outlet	29.9	0.00094	29931	439	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	-619977	Deadband	46330	30.0	28434	439	0	0

**Psychrometric Analysis for AC-B**

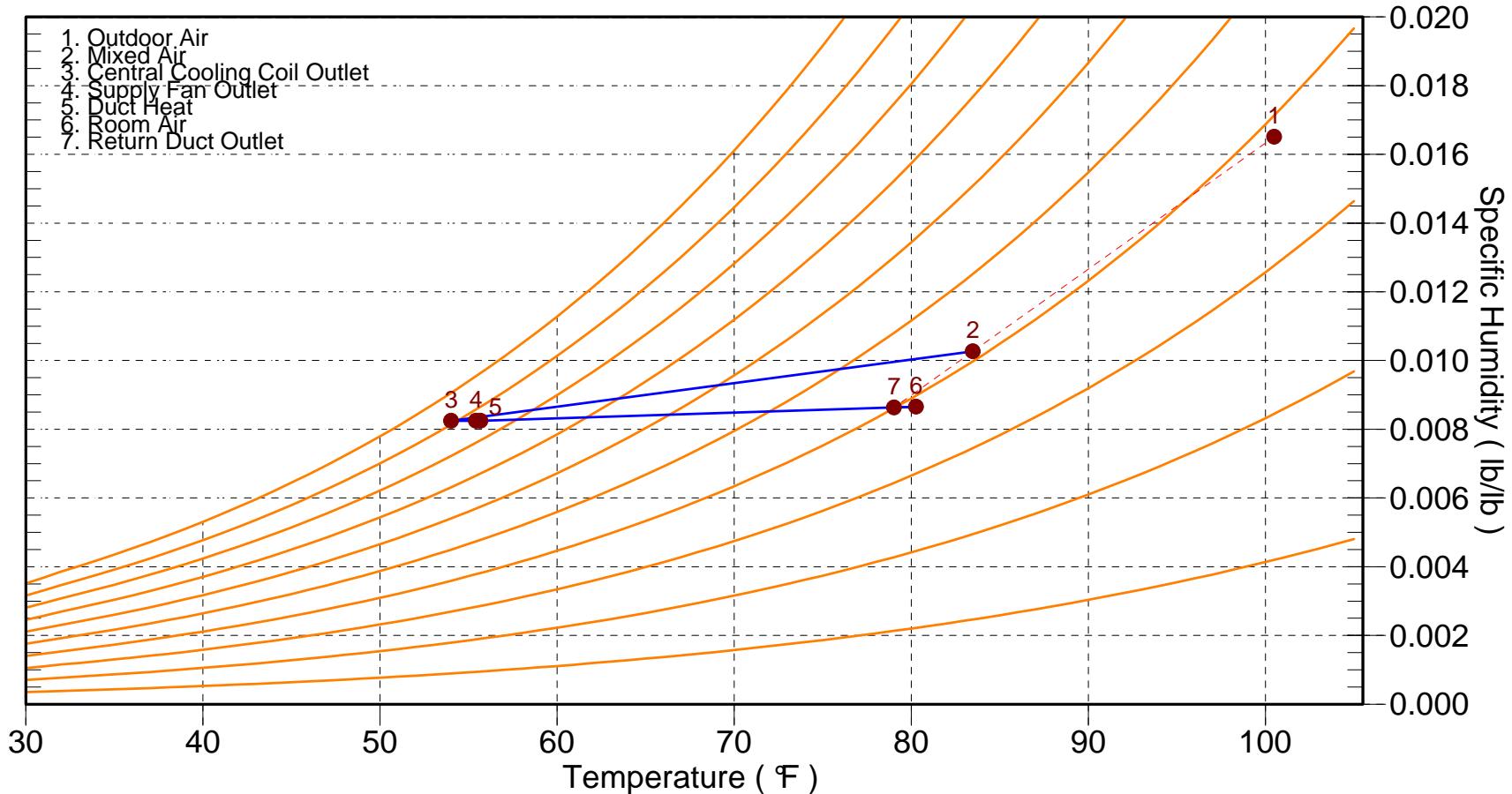
Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

Location: Dallas, Texas

Altitude: 597.0 ft.

Data for: July DESIGN COOLING DAY, 1500



**A 8 DORMS****1. General Details:**

Floor Area ..... 33620.0 ft<sup>2</sup>  
Avg. Ceiling Height ..... 12.0 ft  
Building Weight ..... 70.0 lb/ft<sup>2</sup>

**1.1. OA Ventilation Requirements:**

Space Usage ..... User-Defined  
OA Requirement 1 ..... 20.0 CFM/person  
OA Requirement 2 ..... 0.00 CFM/ft<sup>2</sup>  
Space Usage Defaults ..... User-defined

**2. Internals:****2.1. Overhead Lighting:**

Fixture Type ..... Free Hanging  
Wattage ..... 48413.0 Watts  
Ballast Multiplier ..... 1.00  
Schedule ..... People Lights Equip

**2.4. People:**

Occupancy ..... 432.0 People  
Activity Level ..... Seated at Rest  
Sensible ..... 230.0 BTU/hr/person  
Latent ..... 120.0 BTU/hr/person  
Schedule ..... People Lights Equip

**2.2. Task Lighting:**

Wattage ..... 0.00 W/ft<sup>2</sup>  
Schedule ..... None

**2.5. Miscellaneous Loads:**

Sensible ..... 0 BTU/hr  
Schedule ..... None  
Latent ..... 0 BTU/hr  
Schedule ..... None

**2.3. Electrical Equipment:**

Wattage ..... 1.50 W/ft<sup>2</sup>  
Schedule ..... People Lights Equip

**3. Walls, Windows, Doors:**

Exp.	Wall Gross Area (ft <sup>2</sup> )	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
NW	3240.0	48	0	7
SE	3393.0	48	0	9
NE	1358.0	2	0	0
SW	1358.0	2	0	0
NW	28.0	0	0	1
SE	28.0	0	0	1

**3.1. Construction Types for Exposure NW**

Wall Type ..... Preengineered Bldg Wall  
1st Window Type ..... Inmate Window 3x2  
Door Type ..... Inmate Door

**3.2. Construction Types for Exposure SE**

Wall Type ..... Preengineered Bldg Wall  
1st Window Type ..... Inmate Window 3x2  
Door Type ..... Inmate Door

**3.3. Construction Types for Exposure NE**

Wall Type ..... Preengineered Bldg Wall  
1st Window Type ..... Inmate Window 4x4

**3.4. Construction Types for Exposure SW**

Wall Type ..... Preengineered Bldg Wall  
1st Window Type ..... Inmate Window 4x4

**3.5. Construction Types for Exposure NW**

Wall Type ..... Preengineered Bldg Wall  
Door Type ..... Inmate Door 2

**3.6. Construction Types for Exposure SE**

Wall Type ..... Preengineered Bldg Wall  
Door Type ..... Inmate Door 2

**4. Roofs, Skylights:**

Exp.	Roof Gross Area (ft <sup>2</sup> )	Roof Slope (deg.)	Skylight Qty.
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**Space Input Data**

G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.

01/06/2015  
04:37PM

H	29200.0	0	16
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**4.1. Construction Types for Exposure H**

Roof Type ..... Preengineered Roof  
Skylight Type ..... Skylite 3x8

**5. Infiltration:**

Design Cooling ..... 0.00 CFM  
Design Heating ..... 0.00 CFM  
Energy Analysis ..... 0.00 CFM

Infiltration occurs only when the fan is off.

**6. Floors:**

Type ..... Floor Above Conditioned Space  
**(No additional input required for this floor type).**

**7. Partitions:****7.1. 1st Partition Details:**

Partition Type ..... Ceiling Partition  
Area ..... 4968.0 ft<sup>2</sup>  
U-Value ..... 0.420 BTU/(hr-ft<sup>2</sup>-F)  
Uncondit. Space Max Temp ..... 90.5 F  
Ambient at Space Max Temp ..... 90.5 F  
Uncondit. Space Min Temp ..... 45.0 F  
Ambient at Space Min Temp ..... 45.0 F

**7.2. 2nd Partition Details:**

**(No partition data).**

**Plant Sizing Summary for HUTCHINS BOILER PLT A-E 100% OA**

G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.

07/14/2015  
04:20PM

**1. Plant Information:**

Plant Name ..... **HUTCHINS BOILER PLT A-E 100% OA**  
Plant Type ..... **Hot Water Plant**  
Design Weather ..... **Dallas, Texas**

**2. Heating Plant Sizing Data:**

Maximum Plant Load ..... **10204.4 MBH**  
BTU/(hr-ft<sup>2</sup>) ..... **67.3 BTU/(hr-ft<sup>2</sup>)**  
Floor area served by plant ..... **151587.0 ft<sup>2</sup>**

**3. Coincident Heating Loads for Winter Design**

Air System Name	Mult.	System Heating Coil Load ( MBH )
AC-A 100%OA	1	2254.3
AC-B 100% OA	2	2254.3
AC-D 100% OA	1	1147.1
AC-E 100% OA	2	1147.2

Air system loads are for coils whose heating source is ' Hot Water ' .

**Plant Sizing Summary for HUTCHINS UNIT A-E 100% OA**

G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.

07/14/2015  
04:20PM

**1. Plant Information:**

Plant Name ..... HUTCHINS UNIT A-E 100% OA  
Plant Type ..... Chiller Plant  
Design Weather ..... Dallas, Texas

**2. Cooling Plant Sizing Data:**

Maximum Plant Load ..... 892.1 Tons  
Load occurs at ..... Jul 1400  
ft<sup>2</sup>/Ton ..... 169.9 ft<sup>2</sup>/Ton  
Floor area served by plant ..... 151587.0 ft<sup>2</sup>

**3. Coincident Cooling Loads for Jul 1400**

Air System Name	Mult.	System Cooling Coil Load ( Tons )
AC-A 100%OA	1	198.7
AC-B 100% OA	2	198.7
AC-D 100% OA	1	98.4
AC-E 100% OA	2	98.7

Air system loads are for coils whose cooling source is ' Chilled Water ' .

**Air System Sizing Summary for AC-D**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

**Air System Information**

Air System Name .....	<b>AC-D</b>	Number of zones .....	<b>1</b>
Equipment Class .....	<b>CW AHU</b>	Floor Area .....	<b>16843.0 ft<sup>2</sup></b>
Air System Type .....	<b>SZCAV</b>	Location .....	<b>Dallas, Texas</b>

**Sizing Calculation Information**

Calculation Months .....	<b>Jan to Dec</b>	Zone CFM Sizing .....	<b>Sum of space airflow rates</b>
Sizing Data .....	<b>Calculated</b>	Space CFM Sizing .....	<b>Individual peak space loads</b>

**Central Cooling Coil Sizing Data**

Total coil load .....	<b>52.2</b>	Tons
Total coil load .....	<b>626.8</b>	MBH
Sensible coil load .....	<b>482.9</b>	MBH
Coil CFM at Jul 1500 .....	<b>15292</b>	CFM
Max block CFM .....	<b>15292</b>	CFM
Sum of peak zone CFM .....	<b>15292</b>	CFM
Sensible heat ratio .....	<b>0.770</b>	
ft <sup>2</sup> /Ton .....	<b>322.5</b>	
BTU/(hr-ft <sup>2</sup> ) .....	<b>37.2</b>	
Water flow @ 16.0 °F rise .....	<b>78.39</b>	gpm

Load occurs at .....	<b>Jul 1500</b>	
OA DB / WB .....	<b>100.5 / 78.6</b>	°F
Entering DB / WB .....	<b>83.2 / 66.1</b>	°F
Leaving DB / WB .....	<b>53.3 / 51.9</b>	°F
Coil ADP .....	<b>50.0</b>	°F
Bypass Factor .....	<b>0.100</b>	
Resulting RH .....	<b>38</b>	%
Design supply temp. ....	<b>55.0</b>	°F
Zone T-stat Check .....	<b>1 of 1</b>	OK
Max zone temperature deviation .....	<b>0.0</b>	°F

**Supply Fan Sizing Data**

Actual max CFM .....	<b>15292</b>	CFM
Standard CFM .....	<b>14965</b>	CFM
Actual max CFM/ft <sup>2</sup> .....	<b>0.91</b>	CFM/ft <sup>2</sup>

Fan motor BHP .....	<b>8.38</b>	BHP
Fan motor kW .....	<b>6.64</b>	kW
Fan static .....	<b>2.00</b>	in wg

**Outdoor Ventilation Air Data**

Design airflow CFM .....	<b>3101</b>	CFM
CFM/ft <sup>2</sup> .....	<b>0.18</b>	CFM/ft <sup>2</sup>

CFM/person .....	<b>14.36</b>	CFM/person
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**Zone Sizing Summary for AC-D**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

**Air System Information**

Air System Name .....	AC-D	Number of zones .....	1
Equipment Class .....	CW AHU	Floor Area .....	16843.0 ft <sup>2</sup>
Air System Type .....	SZCAV	Location .....	Dallas, Texas

**Sizing Calculation Information**

Calculation Months .....	Jan to Dec	Zone CFM Sizing .....	Sum of space airflow rates
Sizing Data .....	Calculated	Space CFM Sizing .....	Individual peak space loads

**Zone Sizing Data**

Zone Name	Maximum Cooling Sensible (MBH)	Design Airflow (CFM)	Minimum Airflow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft <sup>2</sup> )	Zone CFM/ft <sup>2</sup>
Zone 1	383.9	14528	14528	Jul 1400	323.3	16843.0	0.86

**Zone Terminal Sizing Data**

No Zone Terminal Sizing Data required for this system.

**Space Loads and Airflows**

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft <sup>2</sup> )	Space CFM/ft <sup>2</sup>
<b>Zone 1</b>							
D 4 DORMS	1	383.9	Jul 1400	14528	323.3	16843.0	0.86

**Air System Design Load Summary for AC-D**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 100.5 °F / 78.6 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F		
	ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)
Window & Skylight Solar Loads	544 ft <sup>2</sup>	28040	-	544 ft <sup>2</sup>	-	-
Wall Transmission	6313 ft <sup>2</sup>	15908	-	6313 ft <sup>2</sup>	31952	-
Roof Transmission	18058 ft <sup>2</sup>	53938	-	18058 ft <sup>2</sup>	191401	-
Window Transmission	352 ft <sup>2</sup>	6141	-	352 ft <sup>2</sup>	19402	-
Skylight Transmission	192 ft <sup>2</sup>	2576	-	192 ft <sup>2</sup>	8141	-
Door Loads	308 ft <sup>2</sup>	2945	-	308 ft <sup>2</sup>	7878	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	864 ft <sup>2</sup>	3322	-	864 ft <sup>2</sup>	9072	-
Ceiling	2484 ft <sup>2</sup>	9550	-	2484 ft <sup>2</sup>	26082	-
Overhead Lighting	24254 W	82753	-	0	0	-
Task Lighting	25265 W	86201	-	0	0	-
Electric Equipment	2250 W	7677	-	0	0	-
People	216	49679	25920	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	34873	1296	10%	29393	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>383603</b>	<b>27216</b>	<b>-</b>	<b>323321</b>	<b>0</b>
Zone Conditioning	-	385371	27216	-	-22829	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	15292 CFM	0	-	15292 CFM	0	-
Ventilation Load	3101 CFM	71022	116686	3101 CFM	42400	0
Supply Fan Load	15292 CFM	22673	-	15292 CFM	-22673	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	1%	3836	-	1%	3233	-
<b>&gt;&gt; Total System Loads</b>	<b>-</b>	<b>482902</b>	<b>143902</b>	<b>-</b>	<b>131</b>	<b>0</b>
Central Cooling Coil	-	482902	143907	-	0	0
<b>&gt;&gt; Total Conditioning</b>	<b>-</b>	<b>482902</b>	<b>143907</b>	<b>-</b>	<b>0</b>	<b>0</b>
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

**Space Design Load Summary for AC-D**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

**TABLE 1.1.A. COMPONENT LOADS FOR SPACE "D 4 DORMS" IN ZONE "Zone 1"**

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 99.9 °F / 78.3 °F OCCUPIED T-STAT 80.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F OCCUPIED T-STAT 70.0 °F		
SPACE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	544 ft <sup>2</sup>	26833	-	544 ft <sup>2</sup>	-	-
Wall Transmission	6313 ft <sup>2</sup>	14815	-	6313 ft <sup>2</sup>	31952	-
Roof Transmission	18058 ft <sup>2</sup>	57102	-	18058 ft <sup>2</sup>	191401	-
Window Transmission	352 ft <sup>2</sup>	5894	-	352 ft <sup>2</sup>	19402	-
Skylight Transmission	192 ft <sup>2</sup>	2473	-	192 ft <sup>2</sup>	8141	-
Door Loads	308 ft <sup>2</sup>	2796	-	308 ft <sup>2</sup>	7878	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	864 ft <sup>2</sup>	3287	-	864 ft <sup>2</sup>	9072	-
Ceiling	2484 ft <sup>2</sup>	9451	-	2484 ft <sup>2</sup>	26082	-
Overhead Lighting	24254 W	82753	-	0	0	-
Task Lighting	25265 W	86201	-	0	0	-
Electric Equipment	2250 W	7677	-	0	0	-
People	216	49679	25920	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	34896	1296	10%	29393	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>383858</b>	<b>27216</b>	<b>-</b>	<b>323321</b>	<b>0</b>

**TABLE 1.1.B. ENVELOPE LOADS FOR SPACE "D 4 DORMS" IN ZONE "Zone 1"**

	Area (ft <sup>2</sup> )	U-Value (BTU/(hr-ft <sup>2</sup> -°F))	Shade Coeff.	COOLING		HEATING (BTU/hr)
				TRANS	SOLAR	
<b>NW EXPOSURE</b>						
WALL	1364	0.096	-	3231	-	6904
WINDOW 1	144	1.040	0.800	2411	4184	7937
DOOR	112	0.460	-	830	-	2731
<b>SE EXPOSURE</b>						
WALL	1413	0.096	-	2924	-	7150
WINDOW 1	144	1.040	0.800	2411	5491	7937
DOOR	140	0.460	-	1037	-	3413
<b>NE EXPOSURE</b>						
WALL	1768	0.096	-	3603	-	8949
WINDOW 1	32	1.040	0.800	536	1116	1764
<b>SW EXPOSURE</b>						
WALL	1768	0.096	-	5057	-	8949
WINDOW 1	32	1.040	0.800	536	1345	1764
<b>NW EXPOSURE</b>						
DOOR	22	0.460	-	163	-	536
DOOR GLASS	6	1.040	0.800	100	174	331
<b>SE EXPOSURE</b>						
DOOR	22	0.460	-	163	-	536
DOOR GLASS	6	1.040	0.800	100	229	331
<b>H EXPOSURE</b>						
ROOF	18058	0.200	-	57102	-	191401
SKYLIGHT	192	0.800	0.570	2473	14696	8141

**System Psychrometrics for AC-D**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

**July DESIGN COOLING DAY, 1500****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	100.5	0.01651	3101	400	71022	116686
Vent - Return Mixing	Outlet	83.2	0.01005	15292	880	-	-
Central Cooling Coil	Outlet	53.3	0.00803	15292	880	482902	143907
Supply Fan	Outlet	54.8	0.00803	15292	880	22673	-
Cold Supply Duct	Outlet	55.0	0.00803	14528	880	-	-
Zone Air	-	80.1	0.00843	14528	1009	385371	27216
Return Plenum	Outlet	80.1	0.00843	14528	1009	0	-
Duct Leakage Air	Outlet	54.8	0.00803	765	880	-	-
Return Duct	Outlet	78.8	0.00841	15292	1002	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	383603	Cooling	385371	80.1	14528	1009	0	0

**System Psychrometrics for AC-D**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

**WINTER DESIGN HEATING****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	17.0	0.00094	3101	400	-42400	0
Vent - Return Mixing	Outlet	27.3	0.00094	15292	433	-	-
Central Cooling Coil	Outlet	27.3	0.00094	15292	433	0	0
Supply Fan	Outlet	28.7	0.00094	15292	433	22673	-
Cold Supply Duct	Outlet	28.5	0.00094	14528	433	-	-
Zone Air	-	30.0	0.00094	14528	441	22829	0
Return Plenum	Outlet	30.0	0.00094	14528	441	0	-
Duct Leakage Air	Outlet	28.7	0.00094	765	433	-	-
Return Duct	Outlet	29.9	0.00094	15292	441	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	-323321	Deadband	22829	30.0	14528	441	0	0

**Psychrometric Analysis for AC-D**

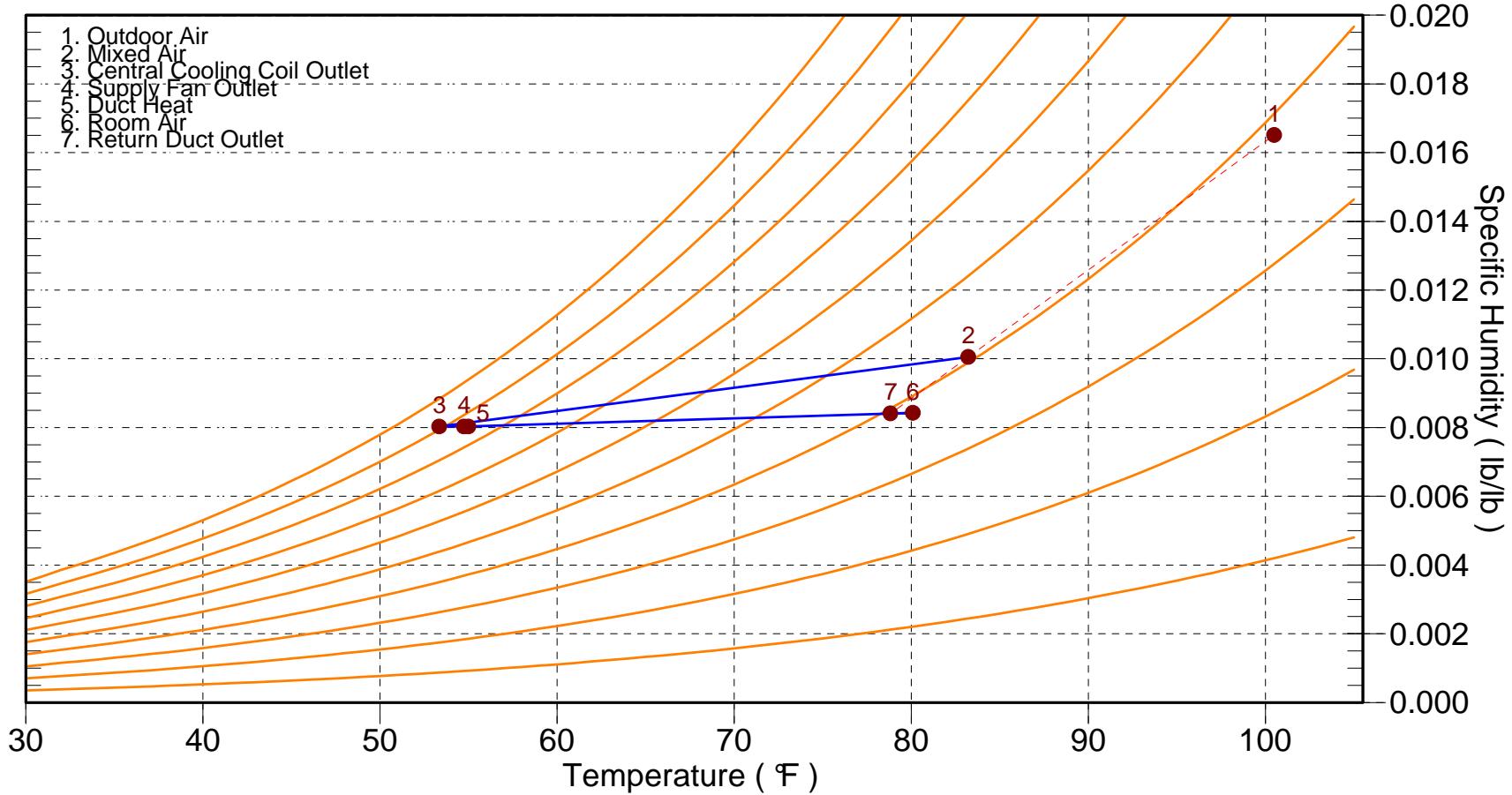
Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:36AM

Location: Dallas, Texas

Altitude: 597.0 ft.

Data for: July DESIGN COOLING DAY, 1500



**Air System Sizing Summary for AC-E**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:37AM

**Air System Information**

Air System Name ..... **AC-E**  
 Equipment Class ..... **CW AHU**  
 Air System Type ..... **SZCAV**

Number of zones ..... **1**  
 Floor Area ..... **16843.0 ft<sup>2</sup>**  
 Location ..... **Dallas, Texas**

**Sizing Calculation Information**

Calculation Months ..... **Jan to Dec**  
 Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**  
 Space CFM Sizing ..... **Individual peak space loads**

**Central Cooling Coil Sizing Data**

Total coil load ..... **51.9** Tons  
 Total coil load ..... **623.0** MBH  
 Sensible coil load ..... **480.9** MBH  
 Coil CFM at Jul 1400 ..... **15293** CFM  
 Max block CFM ..... **15293** CFM  
 Sum of peak zone CFM ..... **15293** CFM  
 Sensible heat ratio ..... **0.772**  
 ft<sup>2</sup>/Ton ..... **324.4**  
 BTU/(hr-ft<sup>2</sup>) ..... **37.0**  
 Water flow @ 16.0 °F rise ..... **77.92** gpm

Load occurs at ..... **Jul 1400**  
 OA DB / WB ..... **99.9 / 78.3** °F  
 Entering DB / WB ..... **83.1 / 66.0** °F  
 Leaving DB / WB ..... **53.3 / 51.9** °F  
 Coil ADP ..... **50.0** °F  
 Bypass Factor ..... **0.100**  
 Resulting RH ..... **38** %  
 Design supply temp. ..... **55.0** °F  
 Zone T-stat Check ..... **1 of 1** OK  
 Max zone temperature deviation ..... **0.0** °F

**Supply Fan Sizing Data**

Actual max CFM ..... **15293** CFM  
 Standard CFM ..... **14966** CFM  
 Actual max CFM/ft<sup>2</sup> ..... **0.91** CFM/ft<sup>2</sup>

Fan motor BHP ..... **8.38** BHP  
 Fan motor kW ..... **6.65** kW  
 Fan static ..... **2.00** in wg

**Outdoor Ventilation Air Data**

Design airflow CFM ..... **3101** CFM  
 CFM/ft<sup>2</sup> ..... **0.18** CFM/ft<sup>2</sup>

CFM/person ..... **14.36** CFM/person

**Zone Sizing Summary for AC-E**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:37AM

**Air System Information**

Air System Name .....	AC-E	Number of zones .....	1
Equipment Class .....	CW AHU	Floor Area .....	16843.0 ft <sup>2</sup>
Air System Type .....	SZCAV	Location .....	Dallas, Texas

**Sizing Calculation Information**

Calculation Months .....	Jan to Dec	Zone CFM Sizing .....	Sum of space airflow rates
Sizing Data .....	Calculated	Space CFM Sizing .....	Individual peak space loads

**Zone Sizing Data**

Zone Name	Maximum Cooling Sensible (MBH)	Design Airflow (CFM)	Minimum Airflow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft <sup>2</sup> )	Zone CFM/ft <sup>2</sup>
Zone 1	383.9	14528	14528	Jul 1400	323.3	16843.0	0.86

**Zone Terminal Sizing Data**

No Zone Terminal Sizing Data required for this system.

**Space Loads and Airflows**

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft <sup>2</sup> )	Space CFM/ft <sup>2</sup>
<b>Zone 1</b>							
E AND F DORMS	1	383.9	Jul 1400	14528	323.3	16843.0	0.86

**Air System Design Load Summary for AC-E**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:37AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 99.9 °F / 78.3 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F		
	ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)
Window & Skylight Solar Loads	544 ft <sup>2</sup>	26833	-	544 ft <sup>2</sup>	-	-
Wall Transmission	6313 ft <sup>2</sup>	14829	-	6313 ft <sup>2</sup>	31952	-
Roof Transmission	18058 ft <sup>2</sup>	57102	-	18058 ft <sup>2</sup>	191401	-
Window Transmission	352 ft <sup>2</sup>	5894	-	352 ft <sup>2</sup>	19402	-
Skylight Transmission	192 ft <sup>2</sup>	2473	-	192 ft <sup>2</sup>	8141	-
Door Loads	308 ft <sup>2</sup>	2796	-	308 ft <sup>2</sup>	7878	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	864 ft <sup>2</sup>	3287	-	864 ft <sup>2</sup>	9072	-
Ceiling	2484 ft <sup>2</sup>	9451	-	2484 ft <sup>2</sup>	26082	-
Overhead Lighting	24254 W	82753	-	0	0	-
Task Lighting	25265 W	86201	-	0	0	-
Electric Equipment	2250 W	7677	-	0	0	-
People	216	49679	25920	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	34898	1296	10%	29393	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>383874</b>	<b>27216</b>	<b>-</b>	<b>323321</b>	<b>0</b>
Zone Conditioning	-	385406	27216	-	-22828	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	15293 CFM	0	-	15293 CFM	0	-
Ventilation Load	3101 CFM	68973	114909	3101 CFM	42400	0
Supply Fan Load	15293 CFM	22674	-	15293 CFM	-22674	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	1%	3839	-	1%	3233	-
<b>&gt;&gt; Total System Loads</b>	<b>-</b>	<b>480892</b>	<b>142125</b>	<b>-</b>	<b>132</b>	<b>0</b>
Central Cooling Coil	-	480892	142138	-	0	0
<b>&gt;&gt; Total Conditioning</b>	<b>-</b>	<b>480892</b>	<b>142138</b>	<b>-</b>	<b>0</b>	<b>0</b>
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

**Space Design Load Summary for AC-E**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:37AM

**TABLE 1.1.A. COMPONENT LOADS FOR SPACE "E AND F DORMS" IN ZONE "Zone 1"**

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 99.9 °F / 78.3 °F OCCUPIED T-STAT 80.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
<b>SPACE LOADS</b>	<b>Details</b>	(BTU/hr)	(BTU/hr)	<b>Details</b>	(BTU/hr)	(BTU/hr)
Window & Skylight Solar Loads	544 ft <sup>2</sup>	26833	-	544 ft <sup>2</sup>	-	-
Wall Transmission	6313 ft <sup>2</sup>	14829	-	6313 ft <sup>2</sup>	31952	-
Roof Transmission	18058 ft <sup>2</sup>	57102	-	18058 ft <sup>2</sup>	191401	-
Window Transmission	352 ft <sup>2</sup>	5894	-	352 ft <sup>2</sup>	19402	-
Skylight Transmission	192 ft <sup>2</sup>	2473	-	192 ft <sup>2</sup>	8141	-
Door Loads	308 ft <sup>2</sup>	2796	-	308 ft <sup>2</sup>	7878	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	864 ft <sup>2</sup>	3287	-	864 ft <sup>2</sup>	9072	-
Ceiling	2484 ft <sup>2</sup>	9451	-	2484 ft <sup>2</sup>	26082	-
Overhead Lighting	24254 W	82753	-	0	0	-
Task Lighting	25265 W	86201	-	0	0	-
Electric Equipment	2250 W	7677	-	0	0	-
People	216	49679	25920	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	34898	1296	10%	29393	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>383874</b>	<b>27216</b>	<b>-</b>	<b>323321</b>	<b>0</b>

**TABLE 1.1.B. ENVELOPE LOADS FOR SPACE "E AND F DORMS" IN ZONE "Zone 1"**

	Area (ft <sup>2</sup> )	U-Value (BTU/(hr-ft <sup>2</sup> -°F))	Shade Coeff.	COOLING		HEATING (BTU/hr)
				TRANS	SOLAR	
<b>SE EXPOSURE</b>						
WALL	1364	0.096	-	2824	-	6904
WINDOW 1	144	1.040	0.800	2411	5491	7937
DOOR	112	0.460	-	830	-	2731
<b>NW EXPOSURE</b>						
WALL	1413	0.096	-	3346	-	7150
WINDOW 1	144	1.040	0.800	2411	4184	7937
DOOR	140	0.460	-	1037	-	3413
<b>SW EXPOSURE</b>						
WALL	1768	0.096	-	5057	-	8949
WINDOW 1	32	1.040	0.800	536	1345	1764
<b>NE EXPOSURE</b>						
WALL	1768	0.096	-	3603	-	8949
WINDOW 1	32	1.040	0.800	536	1116	1764
<b>SE EXPOSURE</b>						
DOOR	22	0.460	-	163	-	536
DOOR GLASS	6	1.040	0.800	100	229	331
<b>NW EXPOSURE</b>						
DOOR	22	0.460	-	163	-	536
DOOR GLASS	6	1.040	0.800	100	174	331
<b>H EXPOSURE</b>						
ROOF	18058	0.200	-	57102	-	191401
SKYLIGHT	192	0.800	0.570	2473	14696	8141

**System Psychrometrics for AC-E**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:37AM

**July DESIGN COOLING DAY, 1400****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	99.9	0.01639	3101	400	68973	114909
Vent - Return Mixing	Outlet	83.1	0.01003	15293	880	-	-
Central Cooling Coil	Outlet	53.3	0.00803	15293	880	480892	142138
Supply Fan	Outlet	54.8	0.00803	15293	880	22674	-
Cold Supply Duct	Outlet	55.0	0.00803	14528	880	-	-
Zone Air	-	80.1	0.00843	14528	1009	385406	27216
Return Plenum	Outlet	80.1	0.00843	14528	1009	0	-
Duct Leakage Air	Outlet	54.8	0.00803	765	880	-	-
Return Duct	Outlet	78.8	0.00841	15293	1002	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	383874	Cooling	385406	80.1	14528	1009	0	0

**System Psychrometrics for AC-E**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

01/28/2015  
 08:37AM

**WINTER DESIGN HEATING****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	17.0	0.00094	3101	400	-42400	0
Vent - Return Mixing	Outlet	27.3	0.00094	15293	433	-	-
Central Cooling Coil	Outlet	27.3	0.00094	15293	433	0	0
Supply Fan	Outlet	28.7	0.00094	15293	433	22674	-
Cold Supply Duct	Outlet	28.5	0.00094	14528	433	-	-
Zone Air	-	30.0	0.00094	14528	441	22828	0
Return Plenum	Outlet	30.0	0.00094	14528	441	0	-
Duct Leakage Air	Outlet	28.7	0.00094	765	433	-	-
Return Duct	Outlet	29.9	0.00094	15293	441	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	-323321	Deadband	22828	30.0	14528	441	0	0

**Psychrometric Analysis for AC-E**

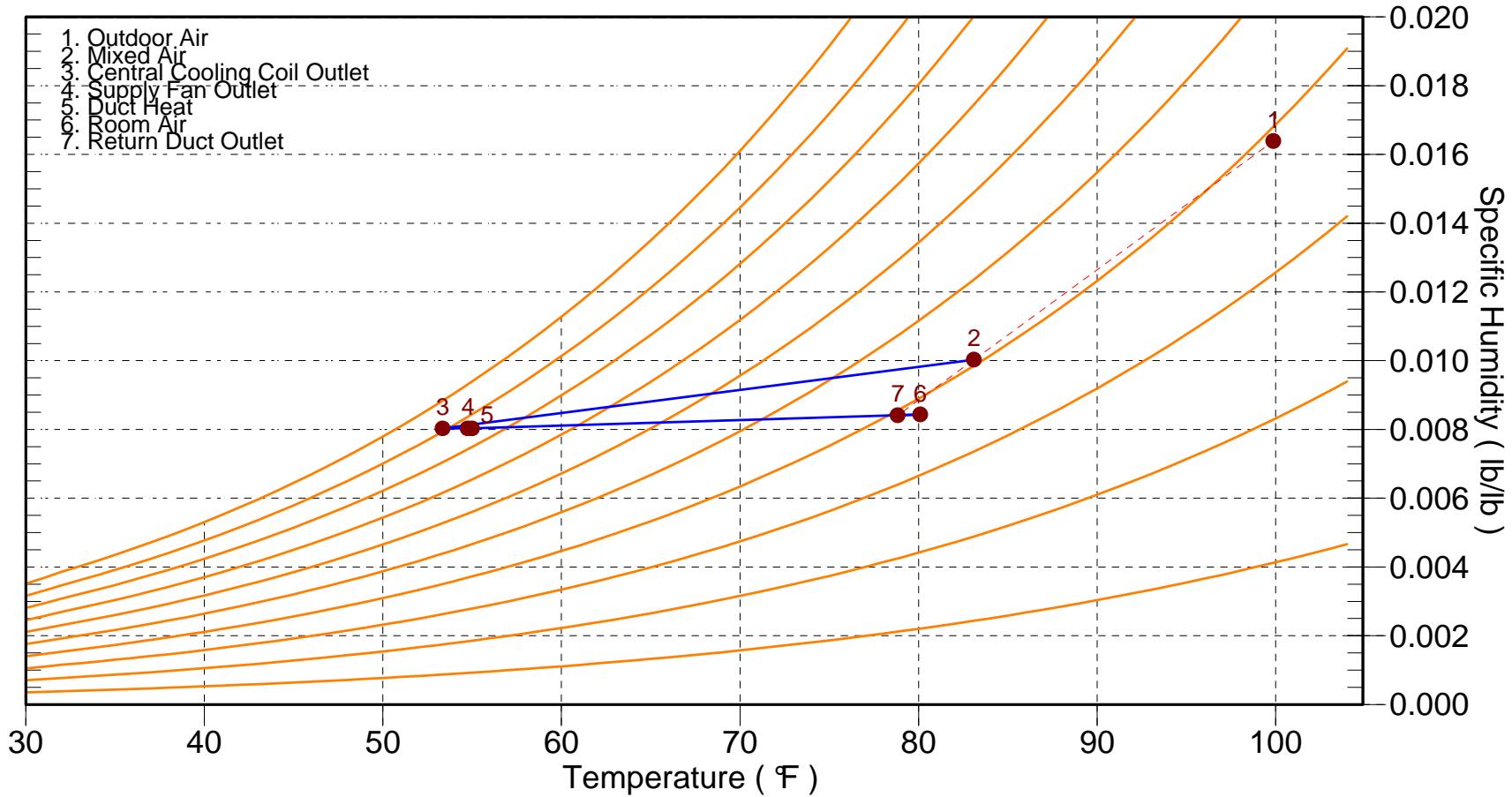
Project Name: G1400100 TDCJ Hutchins Unit Block Load  
Prepared by: Trak Engineering, Inc.

01/28/2015  
08:37AM

Location: Dallas, Texas

Altitude: 597.0 ft.

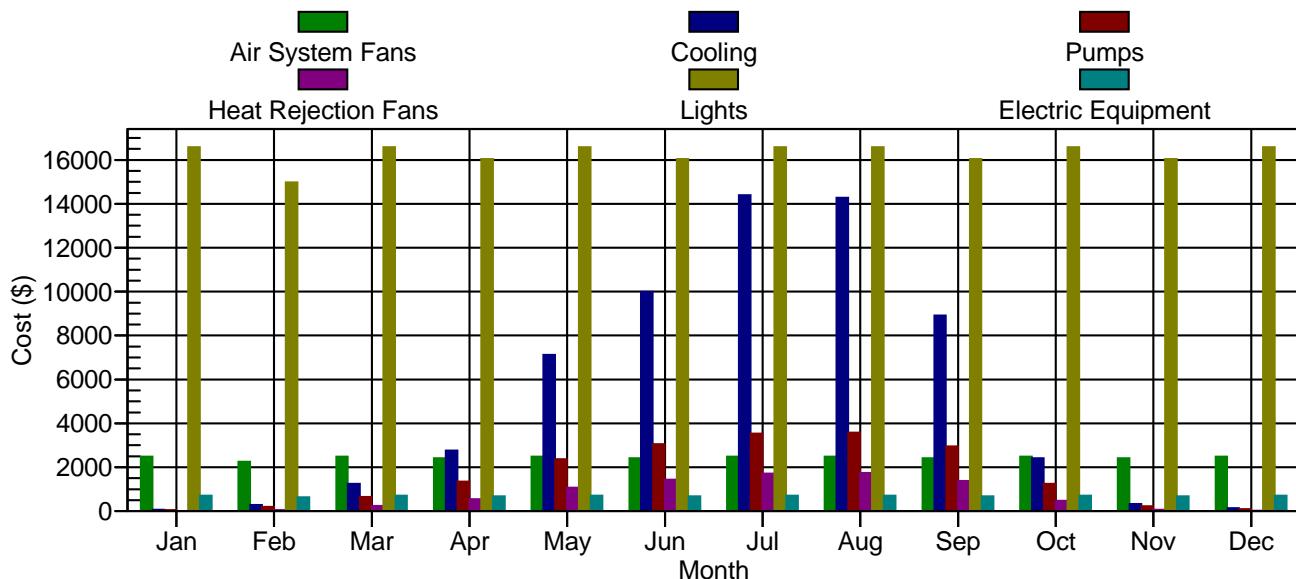
Data for: July DESIGN COOLING DAY, 1400



**Monthly Component Costs - HUTCHINS UNIT WITH CHILLER PLANT**

G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.

07/14/2015  
04:16PM

**1. HVAC Component Costs**

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Heat Rejection Fans (\$)	HVAC Total (\$)
January	2,486	64	0	47	12	2,609
February	2,245	277	0	199	55	2,776
March	2,486	1,246	0	642	232	4,606
April	2,406	2,758	0	1,348	538	7,050
May	2,486	7,122	0	2,365	1,069	13,042
June	2,406	9,993	0	3,046	1,434	16,879
July	2,486	14,390	0	3,533	1,710	22,119
August	2,486	14,278	0	3,582	1,733	22,079
September	2,406	8,912	0	2,943	1,369	15,630
October	2,485	2,405	0	1,238	474	6,602
November	2,406	320	0	223	63	3,012
December	2,486	134	0	96	24	2,740
<b>Total</b>	<b>29,267</b>	<b>61,899</b>	<b>0</b>	<b>19,262</b>	<b>8,714</b>	<b>119,141</b>

**2. Non-HVAC Component Costs**

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	16,578	703	0	0	17,282	19,891
February	14,974	635	0	0	15,609	18,385
March	16,578	703	0	0	17,282	21,888
April	16,044	680	0	0	16,724	23,774
May	16,578	703	0	0	17,282	30,324
June	16,044	680	0	0	16,724	33,603
July	16,578	703	0	0	17,282	39,401
August	16,578	703	0	0	17,282	39,361
September	16,044	680	0	0	16,724	32,354
October	16,578	703	0	0	17,282	23,884
November	16,044	680	0	0	16,724	19,736
December	16,578	703	0	0	17,282	20,022
<b>Total</b>	<b>195,198</b>	<b>8,278</b>	<b>0</b>	<b>0</b>	<b>203,477</b>	<b>322,618</b>

**Hourly Use Profiles - Electric - HUTCHINS UNIT WITH CHILLER PLANT**G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.07/14/2015  
04:16PM

Hour	Wednesday Jan 1 (kW)
0000	531.4
0100	531.4
0200	531.4
0300	531.4
0400	531.4
0500	531.4
0600	531.4
0700	531.4
0800	531.4
0900	531.4
1000	531.4
1100	531.4
1200	531.4
1300	531.4
1400	531.4
1500	531.4
1600	531.4
1700	531.4
1800	531.4
1900	531.4
2000	531.4
2100	531.4
2200	531.4
2300	531.4

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**Monthly Energy Use by Component - HUTCHINS UNIT WITH CHILLER PLANT**

G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.

07/14/2015  
04:18PM

**1. Monthly Energy Use by System Component**

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	49714	44903	49714	48110	49714	48110	49714	49714	48110	49706	48110	49714
<i>Cooling</i>												
Electric (kWh)	1275	5537	24920	55159	142445	199864	287794	285566	178248	48102	6392	2683
Natural Gas ()	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Heating</i>												
Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas ()	4230069	2934442	1301334	368573	188792	21334	2568	0	42076	654587	1424113	3637061
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	934	3975	12845	26952	47297	60924	70656	71643	58864	24757	4468	1921
Heat Rej. Fans (kWh)	237	1091	4637	10753	21388	28684	34209	34670	27373	9485	1269	476
Lighting (kWh)	331570	299482	331570	320874	331570	320874	331570	331570	320874	331570	320874	331570
Electric Eqpt. (kWh)	14062	12701	14062	13608	14062	13608	14062	14062	13608	14062	13608	14062
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas ()	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

**Hourly Use Profiles - Electric - HUTCHINS UNIT WITH CHILLER PLANT**G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.07/14/2015  
04:18PM

Hour	Wednesday Jan 1 (kW)
0000	531.4
0100	531.4
0200	531.4
0300	531.4
0400	531.4
0500	531.4
0600	531.4
0700	531.4
0800	531.4
0900	531.4
1000	531.4
1100	531.4
1200	531.4
1300	531.4
1400	531.4
1500	531.4
1600	531.4
1700	531.4
1800	531.4
1900	531.4
2000	531.4
2100	531.4
2200	531.4
2300	531.4

**Monthly Simulation Results for HUTCHINS UNIT A-E 100% OA**

G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.

07/14/2015  
04:03PM

**Plant Simulation Results (Table 1) :**

Month	Cooling Coil Load (kBtu)	Plant Cooling Load (kBtu)	Chiller Output (kBtu)	Chiller Input (kWh)	Primary Water Dist. Pump (kWh)	Condenser Water Pump (kWh)	Heat Rejection Fan (kWh)
January	12894	14450	14450	1275	485	449	237
February	56183	63002	63002	5537	2126	1848	1091
March	271530	291747	291747	24920	6304	6542	4637
April	599262	640535	640535	55159	12868	14084	10753
May	2004977	2068980	2049963	142445	19956	27341	21388
June	3194375	3273210	3233071	199864	24581	36343	28684
July	5625624	5713310	5309292	287794	27341	43315	34209
August	5039795	5128803	4960985	285566	27751	43892	34670
September	2606988	2683909	2680030	178248	23984	34880	27373
October	565179	601786	601786	48102	11414	13343	9485
November	56878	65491	65491	6392	2686	1783	1269
December	20903	24612	24612	2683	1156	765	476
Total	<b>20054590</b>	<b>20569830</b>	<b>19934970</b>	<b>1237983</b>	<b>160652</b>	<b>224586</b>	<b>174271</b>

**Plant Sizing Summary for HUTCHINS BOILER PLT A-E 100% OA**

G1400100 TDCJ Hutchins Unit Block Load  
Trak Engineering, Inc.

07/14/2015  
01:09PM

**1. Plant Information:**

Plant Name ..... **HUTCHINS BOILER PLT A-E 100% OA**  
Plant Type ..... **Hot Water Plant**  
Design Weather ..... **Dallas, Texas**

**2. Heating Plant Sizing Data:**

Maximum Plant Load ..... **10204.4 MBH**  
BTU/(hr-ft<sup>2</sup>) ..... **67.3 BTU/(hr-ft<sup>2</sup>)**  
Floor area served by plant ..... **151587.0 ft<sup>2</sup>**

**3. Coincident Heating Loads for Winter Design**

Air System Name	Mult.	System Heating Coil Load ( MBH )
AC-A 100%OA	1	2254.3
AC-B 100% OA	2	2254.3
AC-D 100% OA	1	1147.1
AC-E 100% OA	2	1147.2

Air system loads are for coils whose heating source is ' Hot Water ' .

**Air System Sizing Summary for AC-A 100%OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:57PM

**Air System Information**

Air System Name ..... **AC-A 100%OA**  
 Equipment Class ..... **CW AHU**  
 Air System Type ..... **SZCAV**

Number of zones ..... **1**  
 Floor Area ..... **33686.0 ft<sup>2</sup>**  
 Location ..... **Dallas, Texas**

**Sizing Calculation Information**

Calculation Months ..... **Jan to Dec**  
 Sizing Data ..... **User-Modified**

Zone CFM Sizing ..... **Sum of space airflow rates**  
 Space CFM Sizing ..... **Individual peak space loads**

**Central Cooling Coil Sizing Data**

Total coil load ..... **198.7** Tons  
 Total coil load ..... **2384.9** MBH  
 Sensible coil load ..... **1653.2** MBH  
 Coil CFM at Jul 1400 ..... **33971** CFM  
 Max block CFM ..... **33971** CFM  
 Sum of peak zone CFM ..... **33971** CFM  
 Sensible heat ratio ..... **0.693**  
 ft<sup>2</sup>/Ton ..... **169.5**  
 BTU/(hr-ft<sup>2</sup>) ..... **70.8**  
 Water flow @ 16.0 °F rise ..... **298.27** gpm

Load occurs at ..... **Jul 1400**  
 OA DB / WB ..... **99.4 / 73.8** °F  
 Entering DB / WB ..... **99.4 / 73.8** °F  
 Leaving DB / WB ..... **53.3 / 51.5** °F  
 Coil ADP ..... **48.2** °F  
 Bypass Factor ..... **0.100**  
 Resulting RH ..... **37** %  
 Design supply temp. ..... **55.0** °F  
 Zone T-stat Check ..... **0 of 1** OK  
 Max zone temperature deviation ..... **0.0** °F

**Central Heating Coil Sizing Data**

Max coil load ..... **2254.3** MBH  
 Coil CFM at Des Htg ..... **33971** CFM  
 Max coil CFM ..... **33971** CFM  
 Water flow @ 20.0 °F drop ..... **225.55** gpm

Load occurs at ..... **Des Htg**  
 BTU/(hr-ft<sup>2</sup>) ..... **66.9**  
 Ent. DB / Lvg DB ..... **17.0 / 79.8** °F

**Supply Fan Sizing Data**

Actual max CFM ..... **33971** CFM  
 Standard CFM ..... **33245** CFM  
 Actual max CFM/ft<sup>2</sup> ..... **1.01** CFM/ft<sup>2</sup>

Fan motor BHP ..... **18.61** BHP  
 Fan motor kW ..... **14.76** kW  
 Fan static ..... **2.00** in wg

**Outdoor Ventilation Air Data**

Design airflow CFM ..... **33971** CFM  
 CFM/ft<sup>2</sup> ..... **1.01** CFM/ft<sup>2</sup>

CFM/person ..... **78.64** CFM/person

**Zone Sizing Summary for AC-A 100%OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:57PM

**Air System Information**

Air System Name ..... **AC-A 100%OA**  
 Equipment Class ..... **CW AHU**  
 Air System Type ..... **SZCAV**

Number of zones ..... **1**  
 Floor Area ..... **33686.0 ft<sup>2</sup>**  
 Location ..... **Dallas, Texas**

**Sizing Calculation Information**

Calculation Months ..... **Jan to Dec**  
 Sizing Data ..... **User-Modified**

Zone CFM Sizing ..... **Sum of space airflow rates**  
 Space CFM Sizing ..... **Individual peak space loads**

**Zone Sizing Data**

Zone Name	Maximum Cooling Sensible (MBH)	Design Airflow (CFM)	Minimum Airflow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft <sup>2</sup> )	Zone CFM/ft <sup>2</sup>
Zone 1	852.7	32273	32273	Jul 1400	643.8	33686.0	0.96

**Zone Terminal Sizing Data**

No Zone Terminal Sizing Data required for this system.

**Space Loads and Airflows**

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft <sup>2</sup> )	Space CFM/ft <sup>2</sup>
<b>Zone 1</b>							
A 8 DORMS	1	852.7	Jul 1400	67678	643.8	33686.0	2.01

**Air System Design Load Summary for AC-A 100%OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:57PM

ZONE LOADS	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 99.4 °F / 73.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F		
	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	1024 ft <sup>2</sup>	51204	-	1024 ft <sup>2</sup>	-	-
Wall Transmission	9145 ft <sup>2</sup>	18106	-	9145 ft <sup>2</sup>	45422	-
Roof Transmission	36116 ft <sup>2</sup>	209946	-	36116 ft <sup>2</sup>	397248	-
Window Transmission	640 ft <sup>2</sup>	10454	-	640 ft <sup>2</sup>	36608	-
Skylight Transmission	384 ft <sup>2</sup>	4825	-	384 ft <sup>2</sup>	16896	-
Door Loads	504 ft <sup>2</sup>	4154	-	504 ft <sup>2</sup>	13134	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	1728 ft <sup>2</sup>	6562	-	1728 ft <sup>2</sup>	19596	-
Ceiling	4968 ft <sup>2</sup>	18866	-	4968 ft <sup>2</sup>	56337	-
Overhead Lighting	48508 W	165506	-	0	0	-
Task Lighting	50529 W	172402	-	0	0	-
Electric Equipment	4050 W	13819	-	0	0	-
People	432	99359	51840	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	77520	2592	10%	58524	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>852723</b>	<b>54432</b>	<b>-</b>	<b>643765</b>	<b>0</b>
Zone Conditioning	-	856588	54432	-	553663	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	33971 CFM	0	-	33971 CFM	0	-
Ventilation Load	33971 CFM	737679	677270	33971 CFM	1744536	0
Supply Fan Load	33971 CFM	50367	-	33971 CFM	-50367	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	1%	8527	-	1%	6438	-
<b>&gt;&gt; Total System Loads</b>	<b>-</b>	<b>1653161</b>	<b>731702</b>	<b>-</b>	<b>2254270</b>	<b>0</b>
Central Cooling Coil	-	1653161	731702	-	0	0
Central Heating Coil	-	0	-	-	2254270	-
<b>&gt;&gt; Total Conditioning</b>	<b>-</b>	<b>1653161</b>	<b>731702</b>	<b>-</b>	<b>2254270</b>	<b>0</b>
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

**Space Design Load Summary for AC-A 100%OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:57PM

**TABLE 1.1.A. COMPONENT LOADS FOR SPACE "A 8 DORMS" IN ZONE "Zone 1"**

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400		HEATING DATA AT DES HTG			
	COOLING OA DB / WB 99.4 °F / 73.8 °F		HEATING OA DB / WB 17.0 °F / 13.9 °F			
		Sensible	Latent		Sensible	Latent
<b>SPACE LOADS</b>	<b>Details</b>	(BTU/hr)	(BTU/hr)	<b>Details</b>	(BTU/hr)	(BTU/hr)
Window & Skylight Solar Loads	1024 ft <sup>2</sup>	51204	-	1024 ft <sup>2</sup>	-	-
Wall Transmission	9145 ft <sup>2</sup>	18106	-	9145 ft <sup>2</sup>	45422	-
Roof Transmission	36116 ft <sup>2</sup>	209946	-	36116 ft <sup>2</sup>	397248	-
Window Transmission	640 ft <sup>2</sup>	10454	-	640 ft <sup>2</sup>	36608	-
Skylight Transmission	384 ft <sup>2</sup>	4825	-	384 ft <sup>2</sup>	16896	-
Door Loads	504 ft <sup>2</sup>	4154	-	504 ft <sup>2</sup>	13134	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	1728 ft <sup>2</sup>	6562	-	1728 ft <sup>2</sup>	19596	-
Ceiling	4968 ft <sup>2</sup>	18866	-	4968 ft <sup>2</sup>	56337	-
Overhead Lighting	48508 W	165506	-	0	0	-
Task Lighting	50529 W	172402	-	0	0	-
Electric Equipment	4050 W	13819	-	0	0	-
People	432	99359	51840	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	77520	2592	10%	58524	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>852723</b>	<b>54432</b>	<b>-</b>	<b>643765</b>	<b>0</b>

**TABLE 1.1.B. ENVELOPE LOADS FOR SPACE "A 8 DORMS" IN ZONE "Zone 1"**

	Area (ft <sup>2</sup> )	U-Value (BTU/(hr-ft <sup>2</sup> -°F))	Shade Coeff.	COOLING	COOLING	HEATING
				TRANS	SOLAR	TRANS
<b>NW EXPOSURE</b>						
WALL	2756	0.090	-	5634	-	13689
WINDOW 1	288	1.040	0.800	4704	8369	16474
DOOR	196	0.460	-	1416	-	4959
<b>SE EXPOSURE</b>						
WALL	2853	0.090	-	5039	-	14171
WINDOW 1	288	1.040	0.800	4704	10983	16474
DOOR	252	0.460	-	1821	-	6376
<b>NE EXPOSURE</b>						
WALL	1768	0.090	-	3076	-	8781
WINDOW 1	32	1.040	0.800	523	1116	1830
<b>SW EXPOSURE</b>						
WALL	1768	0.090	-	4358	-	8781
WINDOW 1	32	1.040	0.800	523	1345	1830
<b>NW EXPOSURE</b>						
DOOR	22	0.460	-	159	-	557
DOOR GLASS	6	1.040	0.800	98	174	343
<b>SE EXPOSURE</b>						
DOOR	22	0.460	-	159	-	557
DOOR GLASS	6	1.040	0.800	98	229	343
<b>H EXPOSURE</b>						
ROOF	36116	0.200	-	209946	-	397248
SKYLIGHT	384	0.800	0.570	4825	29392	16896

**System Psychrometrics for AC-A 100%OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:57PM

**July DESIGN COOLING DAY, 1400****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	99.4	0.01244	33971	400	737679	677270
Vent - Return Mixing	Outlet	99.4	0.01244	33971	400	-	-
Central Cooling Coil	Outlet	53.3	0.00780	33971	400	1653161	731702
Central Heating Coil	Outlet	53.3	0.00780	33971	400	0	-
Supply Fan	Outlet	54.8	0.00780	33971	400	50367	-
Cold Supply Duct	Outlet	55.0	0.00780	32273	400	-	-
Zone Air	-	80.1	0.00817	32273	525	856588	54432
Return Plenum	Outlet	80.1	0.00817	32273	525	0	-
Duct Leakage Air	Outlet	54.8	0.00780	1699	400	-	-
Return Duct	Outlet	78.8	0.00815	33971	519	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	852723	Cooling	856588	80.1	32273	525	0	0

**WINTER DESIGN HEATING****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	17.0	0.00094	33971	400	-1744536	0
Vent - Return Mixing	Outlet	17.0	0.00094	33971	400	-	-
Central Cooling Coil	Outlet	17.0	0.00094	33971	400	0	0
Central Heating Coil	Outlet	79.8	0.00094	33971	400	2254270	-
Supply Fan	Outlet	81.2	0.00094	33971	400	50367	-
Cold Supply Duct	Outlet	81.0	0.00094	32273	400	-	-
Zone Air	-	64.8	0.00094	32273	400	-553663	0
Return Plenum	Outlet	64.8	0.00094	32273	400	0	-
Duct Leakage Air	Outlet	81.2	0.00094	1699	400	-	-
Return Duct	Outlet	65.6	0.00094	33971	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	-643765	Heating	-553663	64.8	32273	400	0	0

## Psychrometric Analysis for AC-A 100%OA

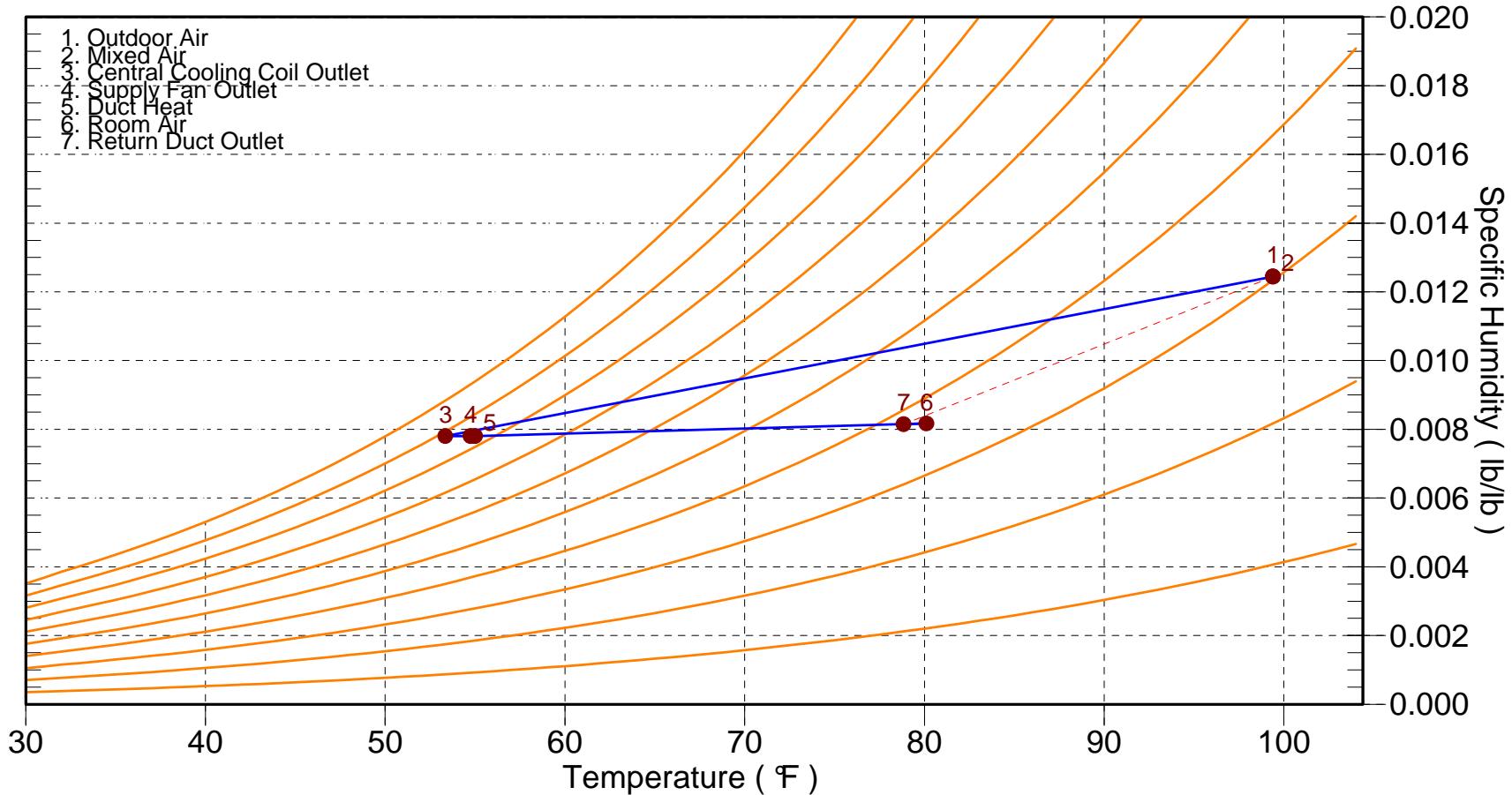
Project Name: G1400100 TDCJ Hutchins Unit Block Load  
Prepared by: Trak Engineering, Inc.

07/14/2015  
12:57PM

Location: Dallas, Texas

Altitude: 597.0 ft.

Data for: July DESIGN COOLING DAY, 1400



**Air System Information**

Air System Name ..... **AC-B 100% OA**  
 Equipment Class ..... **CW AHU**  
 Air System Type ..... **SZCAV**

Number of zones ..... **1**  
 Floor Area ..... **33686.0 ft<sup>2</sup>**  
 Location ..... **Dallas, Texas**

**Sizing Calculation Information**

Calculation Months ..... **Jan to Dec**  
 Sizing Data ..... **User-Modified**

Zone CFM Sizing ..... **Sum of space airflow rates**  
 Space CFM Sizing ..... **Individual peak space loads**

**Central Cooling Coil Sizing Data**

Total coil load ..... **198.7** Tons  
 Total coil load ..... **2384.9** MBH  
 Sensible coil load ..... **1653.2** MBH  
 Coil CFM at Jul 1400 ..... **33972** CFM  
 Max block CFM ..... **33972** CFM  
 Sum of peak zone CFM ..... **33972** CFM  
 Sensible heat ratio ..... **0.693**  
 ft<sup>2</sup>/Ton ..... **169.5**  
 BTU/(hr-ft<sup>2</sup>) ..... **70.8**  
 Water flow @ 16.0 °F rise ..... **298.28** gpm

Load occurs at ..... **Jul 1400**  
 OA DB / WB ..... **99.4 / 73.8** °F  
 Entering DB / WB ..... **99.4 / 73.8** °F  
 Leaving DB / WB ..... **53.3 / 51.5** °F  
 Coil ADP ..... **48.2** °F  
 Bypass Factor ..... **0.100**  
 Resulting RH ..... **37** %  
 Design supply temp. ..... **55.0** °F  
 Zone T-stat Check ..... **0 of 1** OK  
 Max zone temperature deviation ..... **0.0** °F

**Central Heating Coil Sizing Data**

Max coil load ..... **2254.3** MBH  
 Coil CFM at Des Htg ..... **33972** CFM  
 Max coil CFM ..... **33972** CFM  
 Water flow @ 20.0 °F drop ..... **225.55** gpm

Load occurs at ..... **Des Htg**  
 BTU/(hr-ft<sup>2</sup>) ..... **66.9**  
 Ent. DB / Lvg DB ..... **17.0 / 79.8** °F

**Supply Fan Sizing Data**

Actual max CFM ..... **33972** CFM  
 Standard CFM ..... **33246** CFM  
 Actual max CFM/ft<sup>2</sup> ..... **1.01** CFM/ft<sup>2</sup>

Fan motor BHP ..... **18.61** BHP  
 Fan motor kW ..... **14.76** kW  
 Fan static ..... **2.00** in wg

**Outdoor Ventilation Air Data**

Design airflow CFM ..... **33972** CFM  
 CFM/ft<sup>2</sup> ..... **1.01** CFM/ft<sup>2</sup>

CFM/person ..... **78.64** CFM/person

**Zone Sizing Summary for AC-B 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:56PM

**Air System Information**

Air System Name ..... **AC-B 100% OA**  
 Equipment Class ..... **CW AHU**  
 Air System Type ..... **SZCAV**

Number of zones ..... **1**  
 Floor Area ..... **33686.0 ft<sup>2</sup>**  
 Location ..... **Dallas, Texas**

**Sizing Calculation Information**

Calculation Months ..... **Jan to Dec**  
 Sizing Data ..... **User-Modified**

Zone CFM Sizing ..... **Sum of space airflow rates**  
 Space CFM Sizing ..... **Individual peak space loads**

**Zone Sizing Data**

Zone Name	Maximum Cooling Sensible (MBH)	Design Airflow (CFM)	Minimum Airflow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft <sup>2</sup> )	Zone CFM/ft <sup>2</sup>
Zone 1	852.8	32274	32274	Jul 1400	643.8	33686.0	0.96

**Zone Terminal Sizing Data**

No Zone Terminal Sizing Data required for this system.

**Space Loads and Airflows**

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft <sup>2</sup> )	Space CFM/ft <sup>2</sup>
<b>Zone 1</b>							
B and C DORMS	1	852.8	Jul 1400	67678	643.8	33686.0	2.01

**Air System Design Load Summary for AC-B 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

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ZONE LOADS	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 99.4 °F / 73.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F		
	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	1024 ft <sup>2</sup>	51204	-	1024 ft <sup>2</sup>	-	-
Wall Transmission	9145 ft <sup>2</sup>	18133	-	9145 ft <sup>2</sup>	45422	-
Roof Transmission	36116 ft <sup>2</sup>	209946	-	36116 ft <sup>2</sup>	397248	-
Window Transmission	640 ft <sup>2</sup>	10454	-	640 ft <sup>2</sup>	36608	-
Skylight Transmission	384 ft <sup>2</sup>	4825	-	384 ft <sup>2</sup>	16896	-
Door Loads	504 ft <sup>2</sup>	4154	-	504 ft <sup>2</sup>	13134	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	1728 ft <sup>2</sup>	6562	-	1728 ft <sup>2</sup>	19596	-
Ceiling	4968 ft <sup>2</sup>	18866	-	4968 ft <sup>2</sup>	56337	-
Overhead Lighting	48508 W	165506	-	0	0	-
Task Lighting	50529 W	172402	-	0	0	-
Electric Equipment	4050 W	13819	-	0	0	-
People	432	99359	51840	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	77523	2592	10%	58524	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>852753</b>	<b>54432</b>	<b>-</b>	<b>643765</b>	<b>0</b>
Zone Conditioning	-	856243	54432	-	553668	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	33972 CFM	0	-	33972 CFM	0	-
Ventilation Load	33972 CFM	738077	677292	33972 CFM	1744602	0
Supply Fan Load	33972 CFM	50368	-	33972 CFM	-50368	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	1%	8528	-	1%	6438	-
<b>&gt;&gt; Total System Loads</b>	<b>-</b>	<b>1653215</b>	<b>731724</b>	<b>-</b>	<b>2254339</b>	<b>0</b>
Central Cooling Coil	-	1653215	731724	-	0	0
Central Heating Coil	-	0	-	-	2254339	-
<b>&gt;&gt; Total Conditioning</b>	<b>-</b>	<b>1653215</b>	<b>731724</b>	<b>-</b>	<b>2254339</b>	<b>0</b>
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

**Space Design Load Summary for AC-B 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:56PM

**TABLE 1.1.A. COMPONENT LOADS FOR SPACE "B and C DORMS" IN ZONE "Zone 1"**

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 99.4 °F / 73.8 °F OCCUPIED T-STAT 80.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F OCCUPIED T-STAT 72.0 °F		
SPACE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	1024 ft <sup>2</sup>	51204	-	1024 ft <sup>2</sup>	-	-
Wall Transmission	9145 ft <sup>2</sup>	18133	-	9145 ft <sup>2</sup>	45422	-
Roof Transmission	36116 ft <sup>2</sup>	209946	-	36116 ft <sup>2</sup>	397248	-
Window Transmission	640 ft <sup>2</sup>	10454	-	640 ft <sup>2</sup>	36608	-
Skylight Transmission	384 ft <sup>2</sup>	4825	-	384 ft <sup>2</sup>	16896	-
Door Loads	504 ft <sup>2</sup>	4154	-	504 ft <sup>2</sup>	13134	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	1728 ft <sup>2</sup>	6562	-	1728 ft <sup>2</sup>	19596	-
Ceiling	4968 ft <sup>2</sup>	18866	-	4968 ft <sup>2</sup>	56337	-
Overhead Lighting	48508 W	165506	-	0	0	-
Task Lighting	50529 W	172402	-	0	0	-
Electric Equipment	4050 W	13819	-	0	0	-
People	432	99359	51840	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	77523	2592	10%	58524	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>852753</b>	<b>54432</b>	<b>-</b>	<b>643765</b>	<b>0</b>

**TABLE 1.1.B. ENVELOPE LOADS FOR SPACE "B and C DORMS" IN ZONE "Zone 1"**

	Area (ft <sup>2</sup> )	U-Value (BTU/(hr-ft <sup>2</sup> -°F))	Shade Coeff.	COOLING		HEATING (BTU/hr)
				TRANS	SOLAR	
<b>SE EXPOSURE</b>						
WALL	2756	0.090	-	4868	-	13689
WINDOW 1	288	1.040	0.800	4704	10983	16474
DOOR	196	0.460	-	1416	-	4959
<b>NW EXPOSURE</b>						
WALL	2853	0.090	-	5832	-	14171
WINDOW 1	288	1.040	0.800	4704	8369	16474
DOOR	252	0.460	-	1821	-	6376
<b>SW EXPOSURE</b>						
WALL	1768	0.090	-	4358	-	8781
WINDOW 1	32	1.040	0.800	523	1345	1830
<b>NE EXPOSURE</b>						
WALL	1768	0.090	-	3076	-	8781
WINDOW 1	32	1.040	0.800	523	1116	1830
<b>SE EXPOSURE</b>						
DOOR	22	0.460	-	159	-	557
DOOR GLASS	6	1.040	0.800	98	229	343
<b>NW EXPOSURE</b>						
DOOR	22	0.460	-	159	-	557
DOOR GLASS	6	1.040	0.800	98	174	343
<b>H EXPOSURE</b>						
ROOF	36116	0.200	-	209946	-	397248
SKYLIGHT	384	0.800	0.570	4825	29392	16896

**System Psychrometrics for AC-B 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:56PM

**July DESIGN COOLING DAY, 1400****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	99.4	0.01244	33972	400	738077	677292
Vent - Return Mixing	Outlet	99.4	0.01244	33972	400	-	-
Central Cooling Coil	Outlet	53.3	0.00780	33972	400	1653215	731724
Central Heating Coil	Outlet	53.3	0.00780	33972	400	0	-
Supply Fan	Outlet	54.8	0.00780	33972	400	50368	-
Cold Supply Duct	Outlet	55.0	0.00780	32274	400	-	-
Zone Air	-	80.1	0.00817	32274	525	856243	54432
Return Plenum	Outlet	80.1	0.00817	32274	525	0	-
Duct Leakage Air	Outlet	54.8	0.00780	1699	400	-	-
Return Duct	Outlet	78.8	0.00815	33972	519	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	852753	Cooling	856243	80.1	32274	525	0	0

**System Psychrometrics for AC-B 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:56PM

**WINTER DESIGN HEATING****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	17.0	0.00094	33972	400	-1744602	0
Vent - Return Mixing	Outlet	17.0	0.00094	33972	400	-	-
Central Cooling Coil	Outlet	17.0	0.00094	33972	400	0	0
Central Heating Coil	Outlet	79.8	0.00094	33972	400	2254339	-
Supply Fan	Outlet	81.2	0.00094	33972	400	50368	-
Cold Supply Duct	Outlet	81.0	0.00094	32274	400	-	-
Zone Air	-	64.8	0.00094	32274	400	-553668	0
Return Plenum	Outlet	64.8	0.00094	32274	400	0	-
Duct Leakage Air	Outlet	81.2	0.00094	1699	400	-	-
Return Duct	Outlet	65.6	0.00094	33972	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	-643765	Heating	-553668	64.8	32274	400	0	0

**Psychrometric Analysis for AC-B 100% OA**

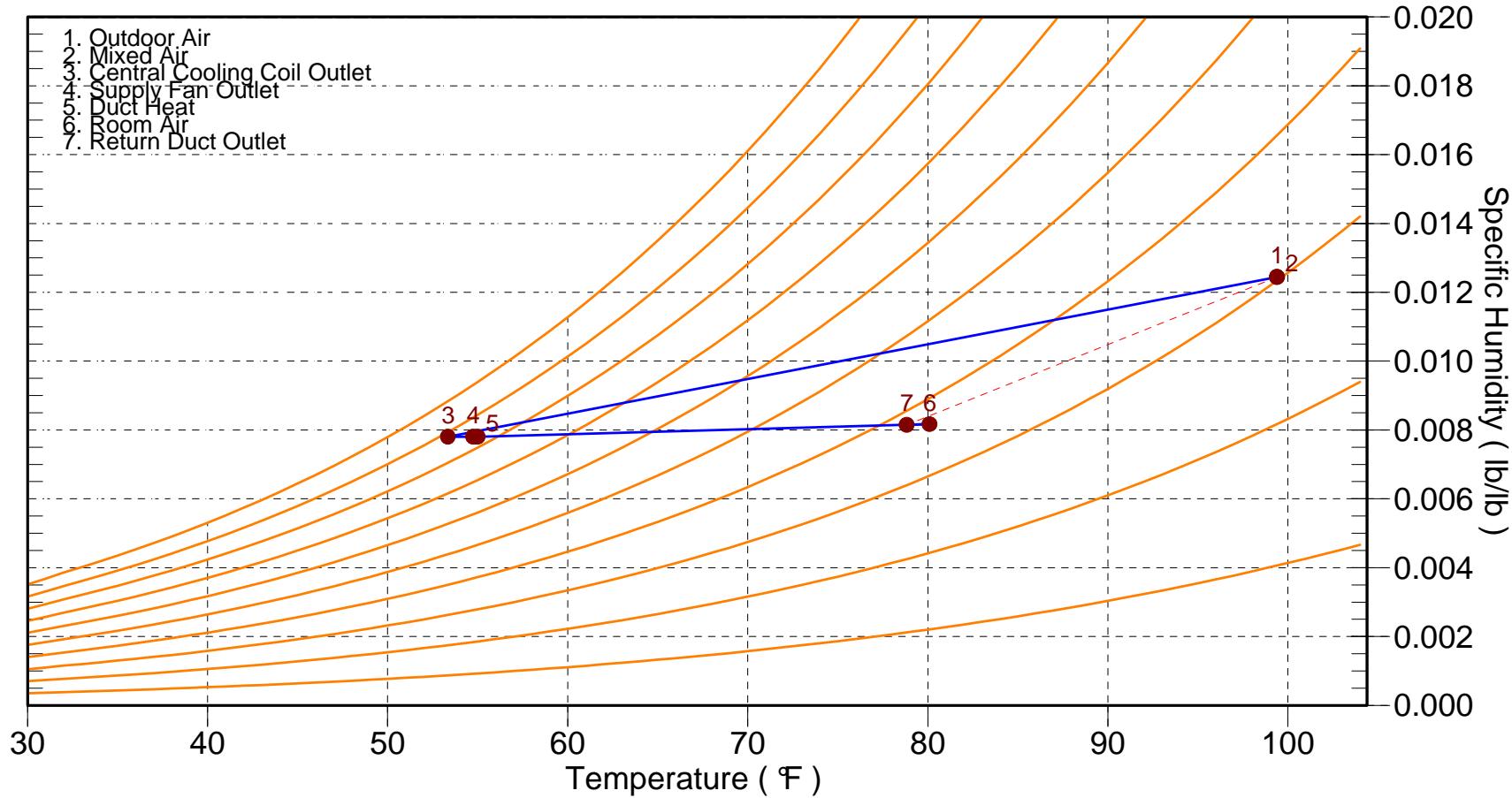
Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:56PM

Location: Dallas, Texas

Altitude: 597.0 ft.

Data for: July DESIGN COOLING DAY, 1400



**Air System Sizing Summary for AC-D 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:58PM

**Air System Information**

Air System Name ..... **AC-D 100% OA**  
 Equipment Class ..... **CW AHU**  
 Air System Type ..... **SZCAV**

Number of zones ..... **1**  
 Floor Area ..... **16843.0 ft<sup>2</sup>**  
 Location ..... **Dallas, Texas**

**Sizing Calculation Information**

Calculation Months ..... **Jan to Dec**  
 Sizing Data ..... **User-Modified**

Zone CFM Sizing ..... **Sum of space airflow rates**  
 Space CFM Sizing ..... **Individual peak space loads**

**Central Cooling Coil Sizing Data**

Total coil load ..... **100.3** Tons  
 Total coil load ..... **1203.6** MBH  
 Sensible coil load ..... **842.3** MBH  
 Coil CFM at Jul 1500 ..... **17286** CFM  
 Max block CFM ..... **17286** CFM  
 Sum of peak zone CFM ..... **17286** CFM  
 Sensible heat ratio ..... **0.700**  
 ft<sup>2</sup>/Ton ..... **167.9**  
 BTU/(hr-ft<sup>2</sup>) ..... **71.5**  
 Water flow @ 16.0 °F rise ..... **150.53** gpm

Load occurs at ..... **Jul 1500**  
 OA DB / WB ..... **100.0 / 74.0** °F  
 Entering DB / WB ..... **100.0 / 74.0** °F  
 Leaving DB / WB ..... **53.9 / 52.0** °F  
 Coil ADP ..... **48.8** °F  
 Bypass Factor ..... **0.100**  
 Resulting RH ..... **37** %  
 Design supply temp. ..... **55.0** °F  
 Zone T-stat Check ..... **0 of 1** OK  
 Max zone temperature deviation ..... **0.1** °F

**Central Heating Coil Sizing Data**

Max coil load ..... **1147.1** MBH  
 Coil CFM at Des Htg ..... **17286** CFM  
 Max coil CFM ..... **17286** CFM  
 Water flow @ 20.0 °F drop ..... **114.77** gpm

Load occurs at ..... **Des Htg**  
 BTU/(hr-ft<sup>2</sup>) ..... **68.1**  
 Ent. DB / Lvg DB ..... **17.0 / 79.8** °F

**Supply Fan Sizing Data**

Actual max CFM ..... **17286** CFM  
 Standard CFM ..... **16916** CFM  
 Actual max CFM/ft<sup>2</sup> ..... **1.03** CFM/ft<sup>2</sup>

Fan motor BHP ..... **9.47** BHP  
 Fan motor kW ..... **7.51** kW  
 Fan static ..... **2.00** in wg

**Outdoor Ventilation Air Data**

Design airflow CFM ..... **17285** CFM  
 CFM/ft<sup>2</sup> ..... **1.03** CFM/ft<sup>2</sup>

CFM/person ..... **80.02** CFM/person

**Zone Sizing Summary for AC-D 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:58PM

**Air System Information**

Air System Name ..... **AC-D 100% OA**  
 Equipment Class ..... **CW AHU**  
 Air System Type ..... **SZCAV**

Number of zones ..... **1**  
 Floor Area ..... **16843.0 ft<sup>2</sup>**  
 Location ..... **Dallas, Texas**

**Sizing Calculation Information**

Calculation Months ..... **Jan to Dec**  
 Sizing Data ..... **User-Modified**

Zone CFM Sizing ..... **Sum of space airflow rates**  
 Space CFM Sizing ..... **Individual peak space loads**

**Zone Sizing Data**

Zone Name	Maximum Cooling Sensible (MBH)	Design Airflow (CFM)	Minimum Airflow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft <sup>2</sup> )	Zone CFM/ft <sup>2</sup>
Zone 1	433.9	16421	16421	Jul 1400	335.2	16843.0	0.97

**Zone Terminal Sizing Data**

No Zone Terminal Sizing Data required for this system.

**Space Loads and Airflows**

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft <sup>2</sup> )	Space CFM/ft <sup>2</sup>
<b>Zone 1</b>							
D 4 DORMS	1	433.9	Jul 1400	35236	335.2	16843.0	2.09

**Air System Design Load Summary for AC-D 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

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	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 100.0 °F / 74.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F		
	ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)
Window & Skylight Solar Loads	544 ft <sup>2</sup>	28040	-	544 ft <sup>2</sup>	-	-
Wall Transmission	6313 ft <sup>2</sup>	13626	-	6313 ft <sup>2</sup>	31354	-
Roof Transmission	18058 ft <sup>2</sup>	100815	-	18058 ft <sup>2</sup>	198624	-
Window Transmission	352 ft <sup>2</sup>	5990	-	352 ft <sup>2</sup>	20134	-
Skylight Transmission	192 ft <sup>2</sup>	2513	-	192 ft <sup>2</sup>	8448	-
Door Loads	308 ft <sup>2</sup>	2884	-	308 ft <sup>2</sup>	8175	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	864 ft <sup>2</sup>	3316	-	864 ft <sup>2</sup>	9798	-
Ceiling	2484 ft <sup>2</sup>	9533	-	2484 ft <sup>2</sup>	28169	-
Overhead Lighting	24254 W	82753	-	0	0	-
Task Lighting	25265 W	86201	-	0	0	-
Electric Equipment	2250 W	7677	-	0	0	-
People	216	49679	25920	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	39303	1296	10%	30470	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>432331</b>	<b>27216</b>	<b>-</b>	<b>335172</b>	<b>0</b>
Zone Conditioning	-	428561	27216	-	286730	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	17286 CFM	0	-	17286 CFM	0	-
Ventilation Load	17285 CFM	383757	334143	17285 CFM	882643	0
Supply Fan Load	17286 CFM	25628	-	17286 CFM	-25628	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	1%	4323	-	1%	3352	-
<b>&gt;&gt; Total System Loads</b>	<b>-</b>	<b>842270</b>	<b>361359</b>	<b>-</b>	<b>1147097</b>	<b>0</b>
Central Cooling Coil	-	842269	361359	-	0	0
Central Heating Coil	-	0	-	-	1147097	-
<b>&gt;&gt; Total Conditioning</b>	<b>-</b>	<b>842269</b>	<b>361359</b>	<b>-</b>	<b>1147097</b>	<b>0</b>
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

**Space Design Load Summary for AC-D 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:58PM

**TABLE 1.1.A. COMPONENT LOADS FOR SPACE "D 4 DORMS" IN ZONE "Zone 1"**

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 99.4 °F / 73.8 °F OCCUPIED T-STAT 80.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F OCCUPIED T-STAT 72.0 °F		
SPACE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	544 ft <sup>2</sup>	26833	-	544 ft <sup>2</sup>	-	-
Wall Transmission	6313 ft <sup>2</sup>	12717	-	6313 ft <sup>2</sup>	31354	-
Roof Transmission	18058 ft <sup>2</sup>	104973	-	18058 ft <sup>2</sup>	198624	-
Window Transmission	352 ft <sup>2</sup>	5750	-	352 ft <sup>2</sup>	20134	-
Skylight Transmission	192 ft <sup>2</sup>	2413	-	192 ft <sup>2</sup>	8448	-
Door Loads	308 ft <sup>2</sup>	2738	-	308 ft <sup>2</sup>	8175	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	864 ft <sup>2</sup>	3281	-	864 ft <sup>2</sup>	9798	-
Ceiling	2484 ft <sup>2</sup>	9433	-	2484 ft <sup>2</sup>	28169	-
Overhead Lighting	24254 W	82753	-	0	0	-
Task Lighting	25265 W	86201	-	0	0	-
Electric Equipment	2250 W	7677	-	0	0	-
People	216	49679	25920	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	39445	1296	10%	30470	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>433891</b>	<b>27216</b>	<b>-</b>	<b>335172</b>	<b>0</b>

**TABLE 1.1.B. ENVELOPE LOADS FOR SPACE "D 4 DORMS" IN ZONE "Zone 1"**

	Area (ft <sup>2</sup> )	U-Value (BTU/(hr-ft <sup>2</sup> -°F))	Shade Coeff.	COOLING		HEATING (BTU/hr)
				TRANS	SOLAR	
<b>NW EXPOSURE</b>						
WALL	1364	0.090	-	2788	-	6775
WINDOW 1	144	1.040	0.800	2352	4184	8237
DOOR	112	0.460	-	809	-	2834
<b>SE EXPOSURE</b>						
WALL	1413	0.090	-	2495	-	7016
WINDOW 1	144	1.040	0.800	2352	5491	8237
DOOR	140	0.460	-	1012	-	3542
<b>NE EXPOSURE</b>						
WALL	1768	0.090	-	3076	-	8781
WINDOW 1	32	1.040	0.800	523	1116	1830
<b>SW EXPOSURE</b>						
WALL	1768	0.090	-	4358	-	8781
WINDOW 1	32	1.040	0.800	523	1345	1830
<b>NW EXPOSURE</b>						
DOOR	22	0.460	-	159	-	557
DOOR GLASS	6	1.040	0.800	98	174	343
<b>SE EXPOSURE</b>						
DOOR	22	0.460	-	159	-	557
DOOR GLASS	6	1.040	0.800	98	229	343
<b>H EXPOSURE</b>						
ROOF	18058	0.200	-	104973	-	198624
SKYLIGHT	192	0.800	0.570	2413	14696	8448

**System Psychrometrics for AC-D 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:58PM

**July DESIGN COOLING DAY, 1500****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	100.0	0.01244	17285	400	383757	334143
Vent - Return Mixing	Outlet	100.0	0.01244	17286	400	-	-
Central Cooling Coil	Outlet	53.9	0.00794	17286	400	842269	361359
Central Heating Coil	Outlet	53.9	0.00794	17286	400	0	-
Supply Fan	Outlet	55.3	0.00794	17286	400	25628	-
Cold Supply Duct	Outlet	55.5	0.00794	16421	400	-	-
Zone Air	-	80.2	0.00830	16421	523	428561	27216
Return Plenum	Outlet	80.2	0.00830	16421	523	0	-
Duct Leakage Air	Outlet	55.3	0.00794	864	400	-	-
Return Duct	Outlet	79.0	0.00828	17286	517	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	432331	Cooling	428561	80.2	16421	523	0	0

**System Psychrometrics for AC-D 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:58PM

**WINTER DESIGN HEATING****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	17.0	0.00094	17285	400	-882643	0
Vent - Return Mixing	Outlet	17.0	0.00094	17286	400	-	-
Central Cooling Coil	Outlet	17.0	0.00094	17286	400	0	0
Central Heating Coil	Outlet	79.8	0.00094	17286	400	1147097	-
Supply Fan	Outlet	81.2	0.00094	17286	400	25628	-
Cold Supply Duct	Outlet	81.0	0.00094	16421	400	-	-
Zone Air	-	64.5	0.00094	16421	400	-286730	0
Return Plenum	Outlet	64.5	0.00094	16421	400	0	-
Duct Leakage Air	Outlet	81.2	0.00094	864	400	-	-
Return Duct	Outlet	65.3	0.00094	17286	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	-335172	Heating	-286730	64.5	16421	400	0	0

**Psychrometric Analysis for AC-D 100% OA**

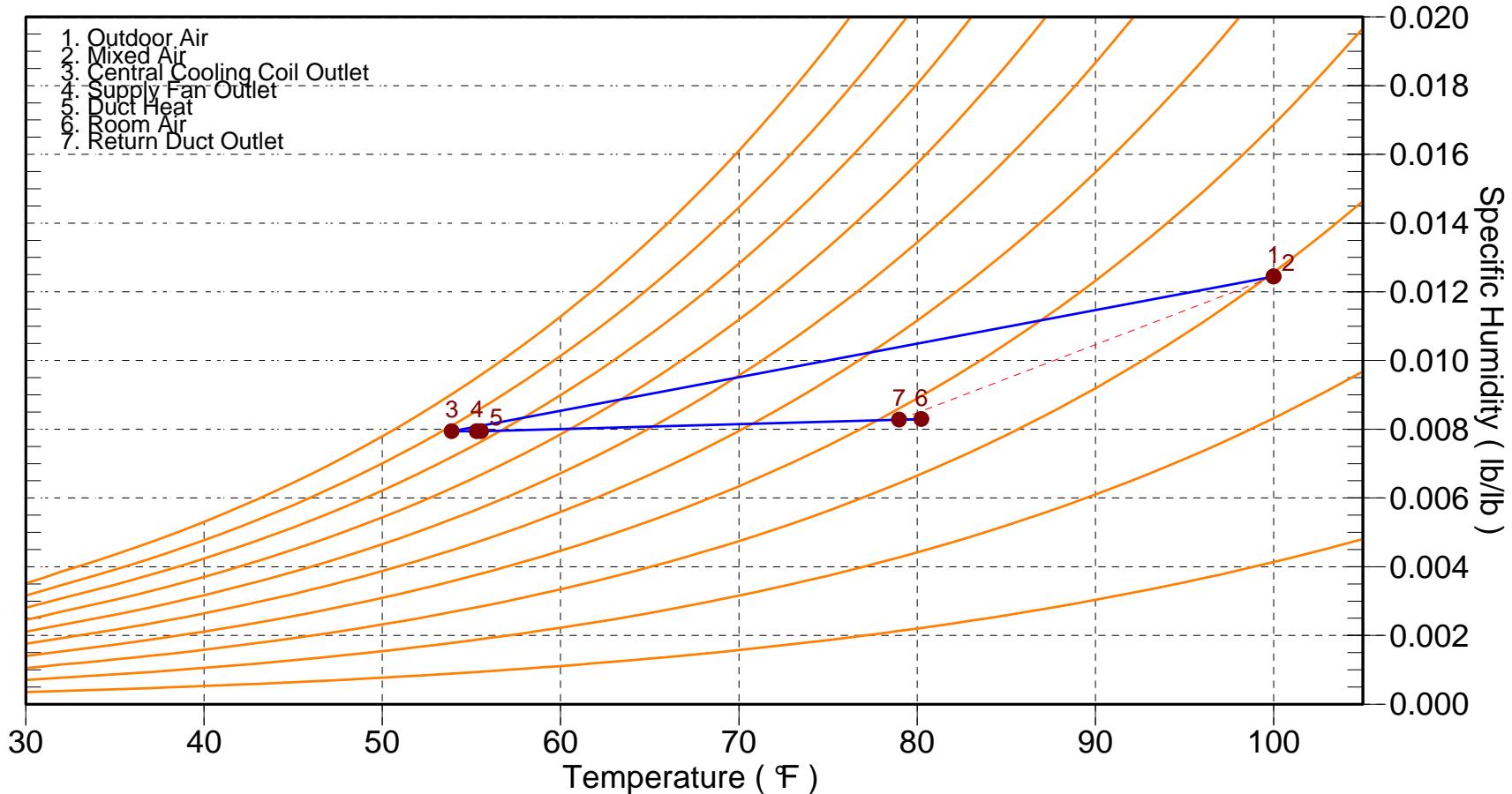
Project Name: G1400100 TDCJ Hutchins Unit Block Load  
Prepared by: Trak Engineering, Inc.

07/14/2015  
12:58PM

Location: Dallas, Texas

Altitude: 597.0 ft.

Data for: July DESIGN COOLING DAY, 1500



**Air System Sizing Summary for AC-E 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:59PM

**Air System Information**

Air System Name ..... **AC-E 100% OA**  
 Equipment Class ..... **CW AHU**  
 Air System Type ..... **SZCAV**

Number of zones ..... **1**  
 Floor Area ..... **16843.0 ft<sup>2</sup>**  
 Location ..... **Dallas, Texas**

**Sizing Calculation Information**

Calculation Months ..... **Jan to Dec**  
 Sizing Data ..... **User-Modified**

Zone CFM Sizing ..... **Sum of space airflow rates**  
 Space CFM Sizing ..... **Individual peak space loads**

**Central Cooling Coil Sizing Data**

Total coil load ..... **100.2** Tons  
 Total coil load ..... **1202.7** MBH  
 Sensible coil load ..... **841.9** MBH  
 Coil CFM at Jul 1500 ..... **17286** CFM  
 Max block CFM ..... **17286** CFM  
 Sum of peak zone CFM ..... **17286** CFM  
 Sensible heat ratio ..... **0.700**  
 ft<sup>2</sup>/Ton ..... **168.0**  
 BTU/(hr-ft<sup>2</sup>) ..... **71.4**  
 Water flow @ 16.0 °F rise ..... **150.42** gpm

Load occurs at ..... **Jul 1500**  
 OA DB / WB ..... **100.0 / 74.0** °F  
 Entering DB / WB ..... **100.0 / 74.0** °F  
 Leaving DB / WB ..... **53.9 / 52.0** °F  
 Coil ADP ..... **48.8** °F  
 Bypass Factor ..... **0.100**  
 Resulting RH ..... **37** %  
 Design supply temp. ..... **55.0** °F  
 Zone T-stat Check ..... **0 of 1** OK  
 Max zone temperature deviation ..... **0.2** °F

**Central Heating Coil Sizing Data**

Max coil load ..... **1147.2** MBH  
 Coil CFM at Des Htg ..... **17286** CFM  
 Max coil CFM ..... **17286** CFM  
 Water flow @ 20.0 °F drop ..... **114.78** gpm

Load occurs at ..... **Des Htg**  
 BTU/(hr-ft<sup>2</sup>) ..... **68.1**  
 Ent. DB / Lvg DB ..... **17.0 / 79.8** °F

**Supply Fan Sizing Data**

Actual max CFM ..... **17286** CFM  
 Standard CFM ..... **16916** CFM  
 Actual max CFM/ft<sup>2</sup> ..... **1.03** CFM/ft<sup>2</sup>

Fan motor BHP ..... **9.47** BHP  
 Fan motor kW ..... **7.51** kW  
 Fan static ..... **2.00** in wg

**Outdoor Ventilation Air Data**

Design airflow CFM ..... **17286** CFM  
 CFM/ft<sup>2</sup> ..... **1.03** CFM/ft<sup>2</sup>

CFM/person ..... **80.03** CFM/person

**Zone Sizing Summary for AC-E 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:59PM

**Air System Information**

Air System Name ..... **AC-E 100% OA**  
 Equipment Class ..... **CW AHU**  
 Air System Type ..... **SZCAV**

Number of zones ..... **1**  
 Floor Area ..... **16843.0 ft<sup>2</sup>**  
 Location ..... **Dallas, Texas**

**Sizing Calculation Information**

Calculation Months ..... **Jan to Dec**  
 Sizing Data ..... **User-Modified**

Zone CFM Sizing ..... **Sum of space airflow rates**  
 Space CFM Sizing ..... **Individual peak space loads**

**Zone Sizing Data**

Zone Name	Maximum Cooling Sensible (MBH)	Design Airflow (CFM)	Minimum Airflow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft <sup>2</sup> )	Zone CFM/ft <sup>2</sup>
Zone 1	433.9	16422	16422	Jul 1400	335.2	16843.0	0.97

**Zone Terminal Sizing Data**

No Zone Terminal Sizing Data required for this system.

**Space Loads and Airflows**

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft <sup>2</sup> )	Space CFM/ft <sup>2</sup>
<b>Zone 1</b>							
E AND F DORMS	1	433.9	Jul 1400	35236	335.2	16843.0	2.09

**Air System Design Load Summary for AC-E 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:59PM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 100.0 °F / 74.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F		
	ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)
Window & Skylight Solar Loads	544 ft <sup>2</sup>	28040	-	544 ft <sup>2</sup>	-	-
Wall Transmission	6313 ft <sup>2</sup>	13656	-	6313 ft <sup>2</sup>	31354	-
Roof Transmission	18058 ft <sup>2</sup>	100815	-	18058 ft <sup>2</sup>	198624	-
Window Transmission	352 ft <sup>2</sup>	5990	-	352 ft <sup>2</sup>	20134	-
Skylight Transmission	192 ft <sup>2</sup>	2513	-	192 ft <sup>2</sup>	8448	-
Door Loads	308 ft <sup>2</sup>	2884	-	308 ft <sup>2</sup>	8175	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	864 ft <sup>2</sup>	3316	-	864 ft <sup>2</sup>	9798	-
Ceiling	2484 ft <sup>2</sup>	9533	-	2484 ft <sup>2</sup>	28169	-
Overhead Lighting	24254 W	82753	-	0	0	-
Task Lighting	25265 W	86201	-	0	0	-
Electric Equipment	2250 W	7677	-	0	0	-
People	216	49679	25920	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	39306	1296	10%	30470	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>432364</b>	<b>27216</b>	<b>-</b>	<b>335172</b>	<b>0</b>
Zone Conditioning	-	428590	27216	-	286733	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	17286 CFM	0	-	17286 CFM	0	-
Ventilation Load	17286 CFM	383336	333631	17286 CFM	882701	0
Supply Fan Load	17286 CFM	25629	-	17286 CFM	-25629	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	1%	4324	-	1%	3352	-
<b>&gt;&gt; Total System Loads</b>	<b>-</b>	<b>841878</b>	<b>360847</b>	<b>-</b>	<b>1147157</b>	<b>0</b>
Central Cooling Coil	-	841878	360847	-	0	0
Central Heating Coil	-	0	-	-	1147157	-
<b>&gt;&gt; Total Conditioning</b>	<b>-</b>	<b>841878</b>	<b>360847</b>	<b>-</b>	<b>1147157</b>	<b>0</b>
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

**Space Design Load Summary for AC-E 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:59PM

**TABLE 1.1.A. COMPONENT LOADS FOR SPACE "E AND F DORMS" IN ZONE "Zone 1"**

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 99.4 °F / 73.8 °F OCCUPIED T-STAT 80.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 17.0 °F / 13.9 °F OCCUPIED T-STAT 72.0 °F		
SPACE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	544 ft <sup>2</sup>	26833	-	544 ft <sup>2</sup>	-	-
Wall Transmission	6313 ft <sup>2</sup>	12730	-	6313 ft <sup>2</sup>	31354	-
Roof Transmission	18058 ft <sup>2</sup>	104973	-	18058 ft <sup>2</sup>	198624	-
Window Transmission	352 ft <sup>2</sup>	5750	-	352 ft <sup>2</sup>	20134	-
Skylight Transmission	192 ft <sup>2</sup>	2413	-	192 ft <sup>2</sup>	8448	-
Door Loads	308 ft <sup>2</sup>	2738	-	308 ft <sup>2</sup>	8175	-
Floor Transmission	0 ft <sup>2</sup>	0	-	0 ft <sup>2</sup>	0	-
Partitions	864 ft <sup>2</sup>	3281	-	864 ft <sup>2</sup>	9798	-
Ceiling	2484 ft <sup>2</sup>	9433	-	2484 ft <sup>2</sup>	28169	-
Overhead Lighting	24254 W	82753	-	0	0	-
Task Lighting	25265 W	86201	-	0	0	-
Electric Equipment	2250 W	7677	-	0	0	-
People	216	49679	25920	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	39446	1296	10%	30470	0
<b>&gt;&gt; Total Zone Loads</b>	<b>-</b>	<b>433906</b>	<b>27216</b>	<b>-</b>	<b>335172</b>	<b>0</b>

**TABLE 1.1.B. ENVELOPE LOADS FOR SPACE "E AND F DORMS" IN ZONE "Zone 1"**

	Area (ft <sup>2</sup> )	U-Value (BTU/(hr-ft <sup>2</sup> -°F))	Shade Coeff.	COOLING		HEATING (BTU/hr)
				TRANS	SOLAR	
<b>SE EXPOSURE</b>						
WALL	1364	0.090	-	2409	-	6775
WINDOW 1	144	1.040	0.800	2352	5491	8237
DOOR	112	0.460	-	809	-	2834
<b>NW EXPOSURE</b>						
WALL	1413	0.090	-	2887	-	7016
WINDOW 1	144	1.040	0.800	2352	4184	8237
DOOR	140	0.460	-	1012	-	3542
<b>SW EXPOSURE</b>						
WALL	1768	0.090	-	4358	-	8781
WINDOW 1	32	1.040	0.800	523	1345	1830
<b>NE EXPOSURE</b>						
WALL	1768	0.090	-	3076	-	8781
WINDOW 1	32	1.040	0.800	523	1116	1830
<b>SE EXPOSURE</b>						
DOOR	22	0.460	-	159	-	557
DOOR GLASS	6	1.040	0.800	98	229	343
<b>NW EXPOSURE</b>						
DOOR	22	0.460	-	159	-	557
DOOR GLASS	6	1.040	0.800	98	174	343
<b>H EXPOSURE</b>						
ROOF	18058	0.200	-	104973	-	198624
SKYLIGHT	192	0.800	0.570	2413	14696	8448

**System Psychrometrics for AC-E 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:59PM

**July DESIGN COOLING DAY, 1500****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	100.0	0.01244	17286	400	383336	333631
Vent - Return Mixing	Outlet	100.0	0.01244	17286	400	-	-
Central Cooling Coil	Outlet	53.9	0.00795	17286	400	841878	360847
Central Heating Coil	Outlet	53.9	0.00795	17286	400	0	-
Supply Fan	Outlet	55.3	0.00795	17286	400	25629	-
Cold Supply Duct	Outlet	55.6	0.00795	16422	400	-	-
Zone Air	-	80.3	0.00830	16422	523	428590	27216
Return Plenum	Outlet	80.3	0.00830	16422	523	0	-
Duct Leakage Air	Outlet	55.3	0.00795	864	400	-	-
Return Duct	Outlet	79.0	0.00829	17286	517	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	432364	Cooling	428590	80.3	16422	523	0	0

**System Psychrometrics for AC-E 100% OA**

Project Name: G1400100 TDCJ Hutchins Unit Block Load  
 Prepared by: Trak Engineering, Inc.

07/14/2015  
 12:59PM

**WINTER DESIGN HEATING****TABLE 1: SYSTEM DATA**

<b>Component</b>	<b>Location</b>	<b>Dry-Bulb Temp (°F)</b>	<b>Specific Humidity (lb/lb)</b>	<b>Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Sensible Heat (BTU/hr)</b>	<b>Latent Heat (BTU/hr)</b>
Ventilation Air	Inlet	17.0	0.00094	17286	400	-882701	0
Vent - Return Mixing	Outlet	17.0	0.00094	17286	400	-	-
Central Cooling Coil	Outlet	17.0	0.00094	17286	400	0	0
Central Heating Coil	Outlet	79.8	0.00094	17286	400	1147157	-
Supply Fan	Outlet	81.2	0.00094	17286	400	25629	-
Cold Supply Duct	Outlet	81.0	0.00094	16422	400	-	-
Zone Air	-	64.5	0.00094	16422	400	-286733	0
Return Plenum	Outlet	64.5	0.00094	16422	400	0	-
Duct Leakage Air	Outlet	81.2	0.00094	864	400	-	-
Return Duct	Outlet	65.3	0.00094	17286	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.057 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4645.1 BTU/(hr-CFM)

Site Altitude = 597.0 ft

**TABLE 2: ZONE DATA**

<b>Zone Name</b>	<b>Zone Sensible Load (BTU/hr)</b>	<b>T-stat Mode</b>	<b>Zone Cond (BTU/hr)</b>	<b>Zone Temp (°F)</b>	<b>Zone Airflow (CFM)</b>	<b>CO2 Level (ppm)</b>	<b>Terminal Heating Coil (BTU/hr)</b>	<b>Zone Heating Unit (BTU/hr)</b>
Zone 1	-335172	Heating	-286733	64.5	16422	400	0	0

**Psychrometric Analysis for AC-E 100% OA**

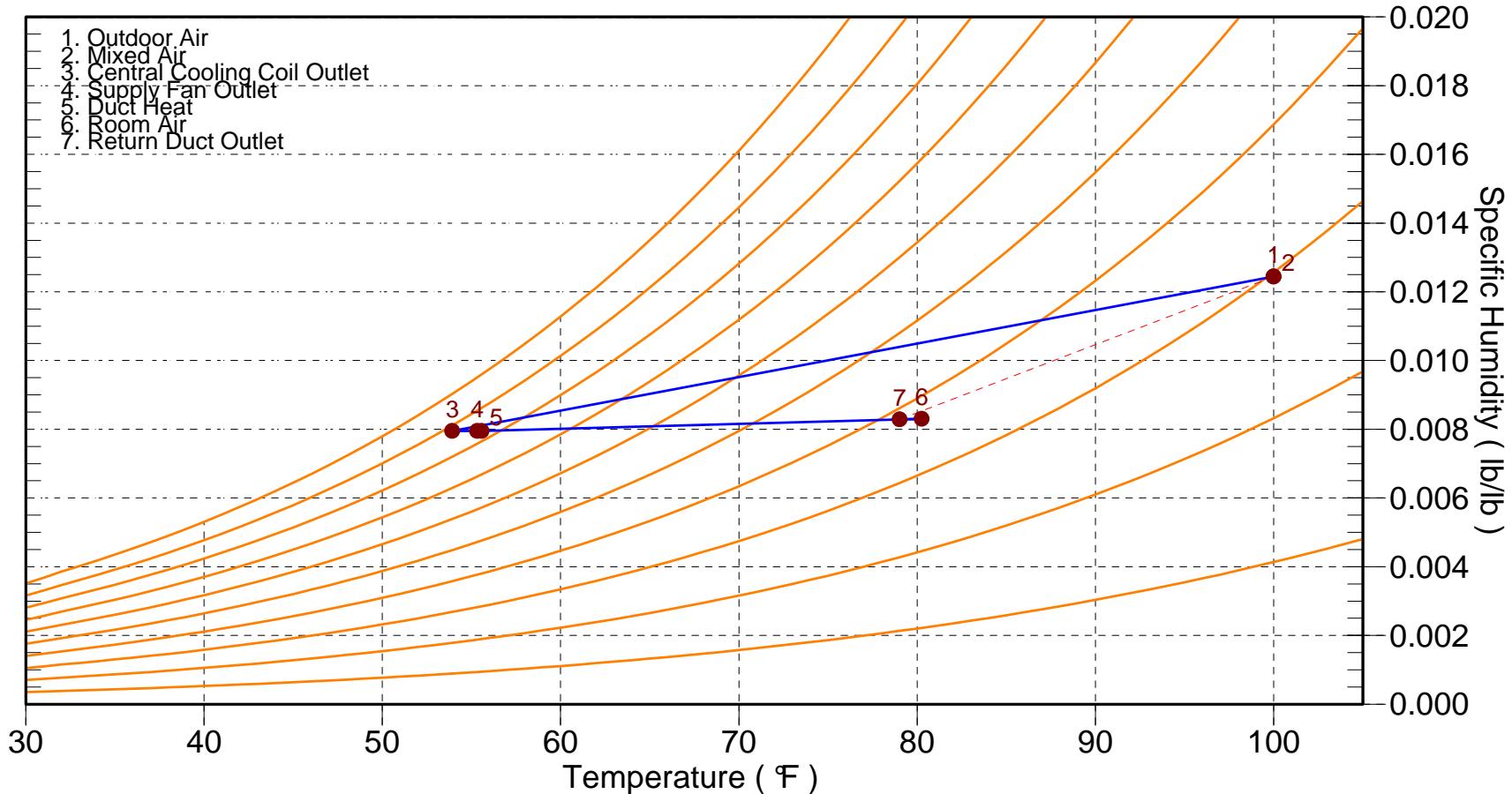
Project Name: G1400100 TDCJ Hutchins Unit Block Load  
Prepared by: Trak Engineering, Inc.

07/14/2015  
12:59PM

Location: Dallas, Texas

Altitude: 597.0 ft.

Data for: July DESIGN COOLING DAY, 1500



# Appendix "C"

## SUPPLEMENTAL EXPERT REPORT OF FRANK TRAKNYAK

General: There are number of inaccuracies and deficiencies in the report that render Mr. Brown's conclusions regarding the method and costs of cooling the Hutchins State Jail unrealistic. These inaccuracies and deficiencies include, but are not limited to, the following:

1. Plaintiffs' report fails to account for the mandatory changes to the building envelope that would accompany the installation of a refrigerated air system. Air conditioning cannot be installed until the building envelope is improved to IECC standards. If the building envelope is not upgraded to include appropriate insulation, and vapor barriers, this will cause significant inefficiencies in any system installed. It will also produce significant problems due to condensation which can lead to corrosion, mold, and mildew. These upgrades are necessary and their cost must be considered. Notably, Plaintiffs report states that the buildings all consist of concrete block walls, when in fact the buildings are completely metal.
2. Plaintiffs' report also fails to take into account the airflow required in the housing areas due to the presence of toilet and bathroom facilities in the vicinity as the dorms with no separation. A minimum of 1 CFM/sqft of ventilation is required in such situations under the exhaust rate in Table 6-4 of ASHRAE 62.1 2010 standard. This drastically affects the capacity required to cool the space in question.
3. The report's selection of a packaged air conditioning HVAC system is inappropriate. These systems are rated for lighter applications than those posed here. They are typically used in commercial or small office settings or more generally in buildings that have a large portion of time (often at night) when the building is not in use. The same is true for a split DX system. Because this application requires 24 hours a day, seven days a week operation, a more durable and reliable system is required, which is why a chilled water system is appropriate. The report's concerns over condensation and mold with a chilled water system do not pose any concerns for inmate welfare. This would only be an issue in the systems' cooling towers if they were not properly maintained. Even still, these structures are located outside and air provided into the building does not come into contact with them.
4. The report indicates that it plans on adding cooling coils to duct work which currently exists within Hutchins State Jail. The existing duct work was designed for heating purposes only. Larger duct work would need to be installed in order to operate properly within an air conditioned system. The cost for installing larger duct work is not captured within this report.
5. In addition to selecting inappropriate equipment with insufficient cooling capacity, the report seems to only include costs for the air conditioning units themselves, and fails to account for all of the materials needed for installation and operation.
6. Regarding Mr. Balsamo's expert report, it is my opinion that the temperature and humidity data collected at the Hutchins State Jail by TDCJ employees from July 18, 2011 to July 22, 2011 ("Hutchins recordings") is not accurate. I base this opinion on several observations. The temperature and humidity conditions recorded at the Dallas Redbird Airport reporting Center ("DRA recordings"), located 6.3 miles away, for the same time frame are significantly lower than the Hutchins recordings. Mr. Balsamo, the plaintiffs' own expert, agrees that the Hutchins recordings are inaccurate because of the significant discrepancy to the DRA recordings. Despite the NWS weather stations being less than 7 miles away and taking into account the possibility of varying topography and geography, the data should not vary to this

degree. In my opinion the data from the Hutchins recordings in the temperature logs is grossly inaccurate given such a large discrepancy.



Frank Traknyak

UNITED STATES DISTRICT COURT  
SOUTHERN DISTRICT OF TEXAS  
HOUSTON DIVISION

STEPHEN MCCOLLUM, *et al.*, §  
*Plaintiffs,* §  
§  
v. § CIVIL NO. 4:14-CV-3253  
§  
§  
BRAD LIVINGSTON, *et al.*, §  
*Defendants.* §  
§

**Exhibit 10**

IN THE UNITED STATES DISTRICT COURT  
FOR THE SOUTHERN DISTRICT OF TEXAS  
HOUSTON DIVISION

DAVID RUIZ, et al., ) CIVIL ACTION NO. H-78-987  
Plaintiffs, )  
UNITED STATES OF AMERICA, ) STIPULATION AND ORDER  
Plaintiff-Intervenor, ) REGARDING MICHAEL UNIT,  
vs. ) MICHAEL-TYPE UNITS,  
JAMES A. LYNAUGH, et al., ) 1000-MAN UNITS AND  
Defendants. ) FUTURE PRISONS

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IT IS STIPULATED between plaintiffs and defendants as follows:

1. The assessment of the Michael Unit contemplated by Section III.D of the Crowding Stipulation and by the Stipulation and Order Pursuant to Section III.D of the Crowding Stipulation ("Section III.D Stipulation") has been conducted by the parties and their experts. In addition, defendants have been authorized by the 70th Legislature to construct two additional units that employ the Michael design with certain modifications, and will seek authorization from the 71st Legislature to construct three additional such units (all of which are referred to in this stipulation as "Michael-type units"). Defendants have also been authorized by the 70th Legislature to construct four 1000-man units, and will seek authorization from the 71st Legislature to construct three additional such units (all of which are referred